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MultiCam® WaterJet User Manual

Introduction	IN 1 – 9
Fast Starts	FS 1 – 31
Keypad and Functions	KF 1 – 34
Menu Items	MI 1 – 61
Options	OP 1 – 9
Connections	CN 1 – 21
Software	SW 1 – 42

Read this manual before using this product.

Failure to follow the instructions and safety precautions in this manual can result in serious injury or death.

Keep this manual in a safe location.

Original Instructions

(a) The business name and full address of the manufacturer and of the authorized representative is as follows:

MultiCam Inc
1025 W Royal Ln
DFW Airport TX 75261

Erik Ketele
Ketele NV
Mechelsesteenweg, 1-3
2540 Hove
BELGIUM

(b) The machinery is designated as WaterJet 1000/3000/4000/6000 Series.

(c) The EC declaration of conformity is attached.

(d) The above CNC machine is designed to modify raw materials that can be used in manufacturing.

(e) The maintenance and repair information is attached.

(f) The workstation likely to be occupied by the operator is a warehouse-like area with high ceilings and heavy flooring and approximately 36” (914.4mm) between the edges of the machine and any auxiliary units appropriate in a warehouse-like area.

(g) The machinery will be used to modify raw materials that can be used in manufacturing.

(h) WARNING: The CNC machine should not be used as a table or desk, heater, ladder, washing station, or prank item as the machine has the ability to crush body parts and materials and can cause serious bodily damage up to and including possible death.

(i) The assembly, installation, and connection information is attached.

(j) The information relating to reducing noise and vibration is attached.

(k) The technician performing the installation will follow an installation checklist as well as an instruction checklist for training operators. This information is attached.

(l) The residual risks inherent in the CNC machine are operator-specific and can include cuts, scratches, burns, amputations, and death resulting from non-adherence to the warning labels placed on the machine and operator-specific association and experience working with CNC machinery.

(m) The protective measures to be adopted by the user include clothing that is not loose or long; minimal to no jewelry and no long-hanging accessories or wardrobe-specific materials; protective eye wear and ear wear; long hair restrained; gloves or comparable hand-covering when handling sharp or hot parts; avoidance of alcohol, drugs, or any other substance that may decrease judgment or alertness; adherence to warning labels placed on the machine as well as operator-specific association and experience working with CNC machinery; avoidance of

placing hands on the tabletop during the cutting sequence; and observance of proper lock-out procedures when completing any maintenance or other work on the machine.

(n) The essential characteristics of the tools are sharp points and sides, blunt edges, dense material, and heavy components.

(o) The conditions that allow the machine to meet the requirement of safety during use, transportation, assembly, and dismantling when out of service, testing, or foreseeable breakdowns are the solid base on which the machine is built, the covers over moving parts, the packaging for shipment, the possible requirement of a crane or forklift to move such pieces as the gantry, the lock-out procedure if followed correctly, optional safety mat and light curtain devices that will halt the motion of the machine, and the automatic stop of all forward motion in the event of a fault.

(p) The instructions for ensuring safe transport, handling, and storage operations include the customer hiring a rigger to facilitate moving the machine; the use of a forklift or crane to move the machine from the delivery van or truck to the final location; a complete inspection of packaged parts to be completed by the installation technician and the customer; information regarding any shipping damages reported immediately to the carrier; insertion of leveling feet so that the machine is at the lowest level possible; and secure anchoring of the machine components to the floor with adequate space for ventilation.

(q) The operating method to be followed if the machine is involved in an accident or breakdown includes the operator or installation technician securing the work area so that the installation technician may determine the cause of the malfunction and troubleshoot a possible workable solution. If a blockage is likely to occur, then the operator or installation technician will halt any forward motion until it is determined that the blockage can be prevented.

(r) The adjustment and maintenance information, as well as the preventive maintenance measures to be observed are as follows:

Safety glasses and hearing protection **should be worn at all times** while operating the machine, and long hair should be **restrained with a cap or net** when near the machines. Operators should never leave the machine unattended during the cutting sequence, and labels should be observed at all times.

All machines should be kept clean when not in use. The build-up of chips and dust on the system should be cleared daily with special attention focused on the gear rack and bearing rails.

All of the bearings should be greased at least twice a month based on an 8-hour work day. The bearings should be greased more often if the machine is in use more than 8 hours a day.

The Lead Screw Z-axis should be lubricated with a non-aerosol, silicon-based lubricant. Operators are cautioned **against** using the lithium grease provided by ***MultiCam*** when lubricating Lead Screws as this may lead to premature wear of the Lead Screw. Ball Screws, however, can be lubricated with lithium grease.

The filters on the electronics enclosure and vacuum pump should also be cleaned.

(s) The instruction designed to enable safely completed adjustment and maintenance, as well as the protective measures to be taken, is as follows:

The ***MultiCam*** CNC machine will provide years of productive service if it is maintained properly. There are daily, weekly, monthly, quarterly, and yearly maintenance steps required for each machine based on a 40-hour work week. ***MultiCam*** recommends that any system used in excess of 40 hours a week should have the maintenance schedule adjusted accordingly.

Daily

The ***MultiCam*** CNC machine should be cleaned off each day, and the water lines should be inspected. All chips should be blown or vacuumed off the machine. Close attention should be paid to the rack area since chip build-up in the rack can cause stalling problems. Customers who operate systems with a Lead Screw Z-axis should lubricate the screw with a non-aerosol, silicon-based lubricant. Operators should **not** use WD-40 on the Z-axis screw for lubrication. Using anything other than what is recommended will result in the premature wear of the Z-axis screw. With Ball Screw systems, oil or lithium grease is an acceptable lubricant.

Weekly

The ***MultiCam*** CNC machine should be cleaned thoroughly each week. The filter on the control box should be vacuumed. Any build-up in the racks or rails should be blown out. The filter or filters on the vacuum hold-down systems should be removed and cleaned. All oil levels (if applicable) in the vacuum hold-down system should be checked and filled if needed. On MG Series routing systems, the Y-axis Ball Screw should also be lubricated with oil or lithium grease. MT Series routing systems will need to follow this procedure for the X-axis Ball Screw as well.

Some older routing systems use a Lead Screw on the X- and Y-axes. These systems should be lubricated with a non-aerosol, silicon-based lubricant. Using anything other than what is recommended may lead to premature wear of the Lead Screw.

Bi-Monthly

Operators should grease all the linear bearing cars at least twice a month for the ***MultiCam*** CNC machine. Jogging the machine while applying slight pressure in the opposite direction will help force the grease into the bearing cars and incorporate the grease throughout all of the bearings.

Monthly

The racks, Y- and Z-axes screws, and X-axis screws on the MT Series routing system should be cleaned with a scrub brush and degreaser once a month following the same lubrication procedure described earlier in addition to the daily and weekly cleaning for all ***MultiCam*** CNC machines. Once the racks are clean, operators should apply a bead of the lithium-based grease.

Quarterly

The X- and Y-axes covers should be removed from the ***MultiCam*** CNC machine every three months so that operators can inspect the transmission or gearboxes for wear. Operators can engage the pinion all the way into

the rack by loosening the mounting bolts of the transmission or gearbox and pushing the assembly up. The tabletop bolts should be checked to ensure they are all tight. Filters in the electrical cabinet should be cleaned.

Bi-Annually

The electrical cabinet should be checked during the bi-annual maintenance performed on the ***MultiCam*** CNC machine. Operators should turn off the power before opening the cabinet and then vacuum out any debris that may have entered the cabinet during regular working conditions. Operators should not use compressed air when cleaning out the cabinet as this action may cause unwanted particles to short out some of the electrical components.

MultiCam recommends that the belts on all transmissions and Lead Screw Z-nuts be replaced every other year.

(t) The specifications of spare parts to be used that may affect the health and safety of operators are attached.

(u) The information on airborne noise emissions is attached.

(v) The machinery is likely to emit non-ionizing radiation that may cause harm to persons, in particular persons with active or non-active implantable medical devices, in these places. The information regarding the radiation emitted for the operator and exposed persons is attached.

Installation Checklist

These machine installation procedures should be followed in order by a ***MultiCam*** Technician, and the CNC machine should be fully functional at the end of the installation. Three asterisks (***) indicate optional steps that may not be applicable to all CNC machines.

Receiving Preparation

☐	1. Machine unpacked & inventoried (suggest customer take digital pictures)	☐	6. Ethernet communication cable run
☐	2. Shipping damage claimed & replacement parts ordered if any	☐	7. Air pressure to machine must be checked. Incoming Air Pressure _____
☐	3. Machine & fume extraction units in final location w/proper space requirements	☐	8. Fume extraction provided ***
☐	4. Leveling feet on	☐	9. Computer provided
☐	5. Proper electrical to disconnect switch from disconnect box on machine, fume extraction unit, & auxiliary units	☐	10. Process gases, consumables, & materials for training with & 3/8 airline hoses

Mechanical Installation: PHASE I

☐	1. Level table (as low as possible).	☐	5. Re-adjust belts (if necessary).
☐	2. Remove all axis covers.	☐	6. Install the pendant to the control box.
☐	3. Reseat the X-axis motor assemblies in the rack.	☐	7. Slightly loosen the bolts connecting the X castings to the gantry.
☐	4. Connect the motor connectors for XA, XB, Y, and Z to the control box.		

Electrical Installation

Make sure the voltage setting is close to 40Vdc without going over.

☐	1. Measure the incoming voltage at C/B with wires 100/L1 and 102/L3.	☐	6. Check the AC voltage at pins 23 & 24 for approximately 26-28Vac for MD4 and approximately 53-55Vac for HP4. If the level is too high, power down to adjust the transformer.
☐	2. Adjust the transformer with the power OFF. Move wire 112 to matching incoming voltage at locations 210, 220, 230, or 240.	☐	7. Power down and attach. Connector N back to the controller box.
☐	3. Check for loose/disconnected wires (including gantry head and spindle box) with the power OFF.	☐	8. Power up the machine.
☐	4. Disconnect the Connector N from the top of the silver controller box inside the cabinet with the power OFF.	☐	9. Adjust the transformer and try again if the voltage is too high and an error message shows on the keypad.
☐	5. Turn the circuit breaker ON and OFF.	☐	10. Check the voltage at the keypad by pressing Shift, Help, and Six. Refer to the Schematics and adjust the transformer if necessary.

Voltage Chart

Incoming at Switch (L1,L2,L3) _____

Transformed Power (Pins 23&24) _____

Mechanical Installation: PHASE II

Electricity is required.

- ☐ **Slightly loosen gantry bolts** – Loosen both sides of the X-axis (moving gantry only).
- ☐ **Hard Home** – If machine will not find limits, then see Help Docs.
- ☐ **Verify Resolutions** – See Help Docs for more information on how to check resolution
- ☐ **Verify Table Parameters** – Jog the full distance in X-, Y-, & Z-axes. Make sure that the gantry & head do not make physical contact with the end stops.
- ☐ **Verify the cutting head is parallel to the table**.
- ☐ **Square Table** – Use a pen taped to the side of the head to make 4 points to verify the square of the gantry. The bigger the perfect rectangle or square, the more accurate.
- ☐ **Tighten Gantry Bolts** – Tighten both sides of the X-axis (moving gantry only).

Suite4 Machine Software Installation

☐	**Reboot Machine** – Check for red letter errors.
☐	**Capture NVRAM** – Check the factory Flash settings before making any modifications. Save to Computer and Tech computers.
☐	**Check Init and Firmware Version** – Type **v** & press *Enter*. Capture the screen or write down the information. Make updates if necessary.

Interface Board	_____	Init File Version Loader	_____
Controller Board Revision	_____	Init File Version STD	_____
Firmware Version (MCIF)	_____	MD4 Version	_____

☐	**Help Files** – Manuals & Help Docs	☐	**JobNameServer** – Confirm operations.
☐	**JobReporter** – Confirm operations.	☐	**JobEditor** – Confirm operations.
☐	**ConnectionManager** – Confirm operations.	☐	**JobConsole** – Check if Auto Preview works & if Job Monitor is on.

ConnectionManager Setup

☐	1. Open ConnectionManager.	☐	6. Highlight the XMI file for the machine and select *Open*.
☐	2. Right-click on No_Connection_Info next to the machine to be added and select *Add*.	☐	7. Select *Yes* at the notice.
☐	3. Highlight either an existing connection if the new machine is being added to the network or *None* if this is a new setup.	☐	8. Refer to the ConnectionManager dialog and locate the specific machine connection.
☐	4. Check the box next to Auto Launch JobNameServer.***	☐	9. Right-click on the connection and select *Report a Problem*.
☐	5. Check the box next to Set Preferred Neti using the Current Neti if the customer wants this computer to be in charge of all communications.***	☐	10. Set up the following email settings: • Email: email address of the contact person for the machine • Server: mail.multicam.com • To: suite4@multicam.com

Mechanical Installation: PHASE III

Option Installation

☐	**Fume Extraction** – Adjust the air flow.	☐	**Bar Code**

☐ **Run a test file to verify machine operation**.

Introduction

top

Customer Responsibilities for Safety 2
Power Lockout Instructions 4
Labels 5

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Customer Responsibilities for Safety

As the user of the ***MultiCam*** machine, each customer **must** follow all safety procedures that are clearly outlined when operating each machine and its parts. Failure to do so may result in damage to property or personnel and could even result in death. These machines are powerful and should always be treated with care.

Customers should make plans for safeguarding themselves and their work areas at the point of operation as all ***MultiCam*** machines have been designed and constructed to operate under specific parameters relating to the particular application. As a result, ANSI B-11 *Safety Standards* states that "It shall be the responsibility of the end-user (buyer) to provide, and ensure the use of a guard, guarding device, awareness barrier, awareness device or shield..." in order to maintain the required level of protection.

MultiCam has available certain safety shields and guards applicable to our machines. Please contact our office for styles, types, and prices.

Personal Safety Precautions

All customers should become familiar with all aspects of their machines.

Any person who operates or does any maintenance on this equipment should be aware that safety procedures are an important part of the daily job. Customers and related personnel should learn how the equipment functions and be able to respect the capabilities of the machinery. Anyone working on or around the equipment should understand the potential losses associated with mishandling the machinery and its parts and be able and willing to follow all safety precautions. Sudden movement, loud noises, horseplay, etc. must be avoided, as such distractions may result in unsafe conditions.

Accidents can occur if clothing or other articles become entangled in the cutter or other moving parts of the machines. The following suggestions, if followed, will reduce the chance of having these types of accidents:

1. Wear **approved eye and hearing protection** at all times when operating the machine.
2. Restrain long hair with a **cap or net** when near the machines.
3. Avoid wearing neckties and scarves during machine operation.
4. Avoid wearing loose fitting clothing during machine operation.
5. Avoid wearing hanging jewelry during machine operation.
6. Wear gloves only when handling sharp or hot parts.
7. Avoid operating this and any other equipment if affected by alcohol, drugs, or any other substance or condition that may decrease judgment or alertness.
8. **Observe and follow all safety signs** on the machine and in the surrounding areas.
9. Avoid placing hands on the tabletop when the machine is turned on.
10. Lock out the incoming power supply when any type of maintenance or other work is being performed on the machine.

Work Area Safety

Fire extinguishers should always be readily accessible, and operators should always familiarize themselves with the fire prevention recommendations for each component of the CNC system. It is important to always keep the work area **clean and uncluttered**. Oil, debris, or water on the floor can cause unsafe conditions. Customers should be sure that all work areas are free of hazardous obstructions and that all tools and other equipment are returned to their proper storage place when not in use. Operators should never leave the machine unattended during the cutting sequence.

Installation Safety

An electrician must read and understand the electrical schematics prior to connecting the machine to the local power system. Connecting the wrong voltage power will void the warranty. All switches should be turned to the OFF position before power is connected. The main disconnect switch should always be locked in the OFF position if the machine is left unattended. When the machine is installed, the electrician or customer should be sure that all motors rotate in the correct direction. Introduction

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Power Lockout Instructions

MultiCam machines are equipped with a built-in main power lockout device. If any kind of repair work or maintenance is being performed to the machine or control cabinet, the operator should **disconnect power** from the machine **before starting work**.

1. Turn the main disconnect switch to the OFF position.

2. Flip out the plastic lockout latch.

3. Insert any padlock into one of the holes of the lockout latch. With the plastic lockout latch in this position, the switch cannot be moved to the ON position.

1

2

3

4. Throw the bulkhead switch to the OFF position.

5. Open the control cabinet.

6. Make sure the LEDs on the drives and inverters are not lit. It may take a few minutes for the light from the LEDs to fade away.

7. Make sure the incoming voltage for L1, L2, and L3 is 0v.

8. Follow the operator's standard Tag Out procedure in tagging the disconnect switch.

Introduction

Labels

Each machine produced by ***MultiCam*** includes certain cautions, warnings, dangers, and notices placed on the moving parts of the machine (e.g., gantry, carriage) as well as the stationary parts (e.g., electrical enclosure). These labels are in place to encourage employees to observe safe operating practices at all times. The text on these labels is almost always capitalized and presented in bold format. Any auxiliary equipment (e.g., intensifier, chiller) will include vendor-specific labels advising the customer of proper safety practices regarding those units as well. The serial number label is unique to the machine. The most common labels are identified below.

Cautions

Caution labels indicate the potential for minor or moderate injury and are usually yellow with black writing. These labels are normally placed on the gantry, axis covers, and any other covers that are located at the front of the machine.

Warnings

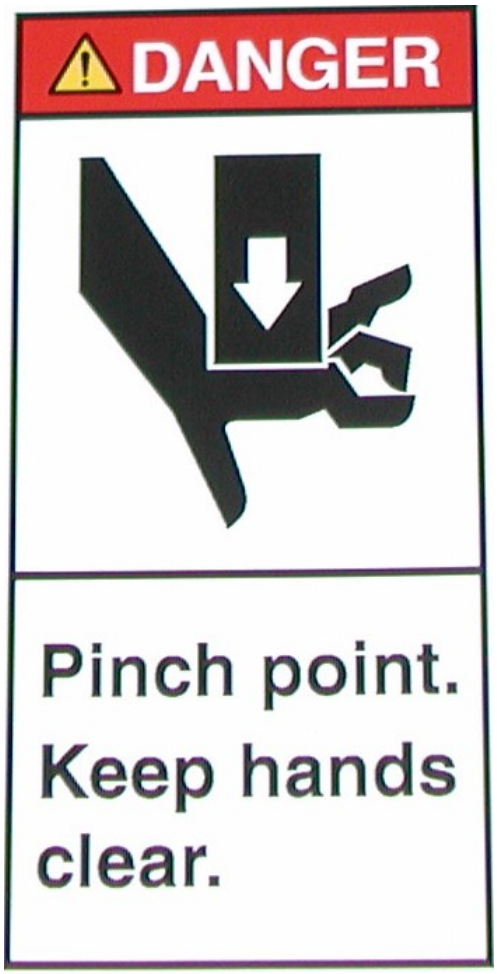
Warning labels indicate the potential for death or serious injury and usually show the word WARNING in black writing against an orange background. These labels are normally located in areas where serious injury could be sustained, such as the carriage.

WARNING
Crush hazard.
To avoid tip over, this equipment must be securely fastened to the floor.

WARNING
Enclosure is TOP–HEAVY
• Stabilize enclosure before opening doors.
• Follow guidelines in "Large Enclosure Handling Manual".
• DO NOT remove this label until enclosure is permanently installed.
• Label must be reattached if removed for painting.
• To get additional copies of the "Large Enclosure Handling Manual" or labels, call 1–800–355–3560.
93268001, Dwg. Rev. G

Danger

Danger labels indicate the probability of death or serious injury and usually show the word DANGER in white writing against a red background. These labels are normally located in areas where serious injury could occur, such as the abrasive cutting head.



Notices

Notice labels indicate the potential for property damage and usually show the word NOTICE in white writing against a blue backdrop. This label is normally located at the front of the machine.

Serial Number

The serial number label indicates the name and contact information for the company, specific serial number for the machine, and voltage and amp information for the operating system. This specific information relates to the table only. Each auxiliary unit has its own serial number tag with machine-specific information.

Introduction

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Fast Starts

top

Fast Start WaterJet	2
Quick Start Guide to Operating NC GeoMate	5
Fixing a Leak on a 3000 Series WaterJet	10
Changing Cutting Nozzles	12
Squaring the Table	21
Hints and Tips	24
Contacting MultiCam	26
Maintenance	27
Maintenance Log	29
Warranty for WaterJets	30
Warranty Registration List	31

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Fast Start WaterJet

1. **Turn on Air Supply**
   Make sure pressure is at a minimum of 90 psi at the CNC machine.
   Make adjustments as needed.

2. **Turn on Water Source to Intensifier**
   Open the water control valve.

3. **Check Abrasive Hopper (if applicable)**
   Make sure the hopper is pressurized at 40psi.
   Add abrasive if needed.

4. **Turn on Power to *MultiCam* Control Cabinet**
   Locate the power switch, the round knob located on the control enclosure.
   Rotate to the ON position.

5. **Make Sure E-stop is Released**
   Check the E-stop button on the Intensifier unit and release if necessary.

6. **Find Machine Hard Home**
   Press Shift and Go Home to find the hard home 0,0 or the machine home by indexing the gantry, carriage, and Z assembly off of the proximity (limit) switches.

7. **Turn on Chiller, Closed Loop System, and Abrasive Removal System (if applicable)**
   See Manufacturer's guidelines.
   Auxiliary items must be turned on before the intensifier is turned on.

8. **Turn on Power to Intensifier**
   Locate the Intensifier main power switch, the black switch on the KMT Intensifier unit.
   Rotate to the ON position.
   Allow PLC to boot.
   KMT SLV or SLV PRO only – Press the white button on the Intensifier. The white button will illuminate when the intensifier has entered a ready state.
   All systems – Make sure inlet cutting water pressure is at a minimum of 35 psi.

9. **Switch Intensifier to Remote** (on SLV or SLV PRO pumps only)
   Locate the Intensifier local/remote key switch.
   Make sure the Intensifier is in Remote mode.

10. **Start the Intensifier**
    Move to the operator station.
    Rotate the Intensifier Start switch to Start and release it. The switch will remain in the ON position.

11. **Set Home**

Press Jog Speed to set the speed of the movement to slow, medium, or fast.

Press Jog Arrows to place the **center of the waterjet cutting head** over the front right corner of the material.

Press Set Home to set the home location for the head assembly. The system will prompt the operator as to whether the selected position should be set as home, and the display will read "Press Down to set Rotation Point." See Rotate File for a description of this function.

Press Enter to confirm the position.

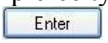
12. **Set Surface**

Press Jog Arrows to place the **center of the waterjet cutting head** over the material to be cut.

Press Set Surface .

Press Z-axis Jog Arrows to lower the Z-axis until the bottom of the head assembly reaches about 1/8" (3.18mm) above the material.

Press Enter to set the surface. This will cause the Z-axis to move up slowly to the Lift Height.

13. **Set Up NC GeoMate** (see Quick Start Guide to Operating NC GeoMate for more details)
Open NC GeoMate.
Load a drawing (*.dxf) file.
Click on to access the cutting parameter calculator.
Select the material from the dropdown menu.
Adjust the thickness as needed.
Adjust the finish as needed.
Set the pierce type.
Select  and then select .
Click back onto the main NC GeoMate dialog and click on to access toolpathing.
Click to play the file from the beginning.
Click to save the output cut (*.ucj) file to DNC.

14. **Access DNC**

Press DNC . The keypad will display a list of job folders and job files, which are located in the C:\Dncfiles directory.

Press X-axis Jog Arrows until the appropriate folder is highlighted in blue.

Press Enter to display the DNC files that are available in that particular folder.

Press X-axis Jog Arrows until the appropriate file is highlighted in blue.

Press Start to begin the file.

15. **Start / Cancel / Pause**

Press Start to begin the cutting sequence.

Press Cancel to abort the cutting sequence.

Press Pause to yield the cutting sequence.
Operators should never leave the machine unattended during the cutting sequence.

There are several auxiliary units involved in the everyday operations of the waterjet that must be shut down in sequence to prevent damage or unnecessary wear. The proper sequence for shutting down the waterjet is listed below.

16. **Power Down WaterJet and Intensifier**

Rotate Intensifier Stop switch at the operator station to the OFF position.

Press WaterJet Test and select 1 to open the jet valve to bleed off the water pressure.

Press Menu to access the menu system.

Press X-axis Jog Arrows until Shutdown is highlighted in blue.

Press Enter twice to shut down the system.

Locate the power switch, the round knob located on the ***MultiCam*** control cabinet, and rotate to the OFF position.

Locate the Intensifier main power switch, the black switch on the KMT Intensifier unit, and rotate to the OFF position.

Turn off the Chiller if applicable.

Turn off the water supply.

Fast Starts

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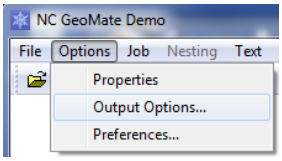
Quick Start Guide to Operating NC GeoMate

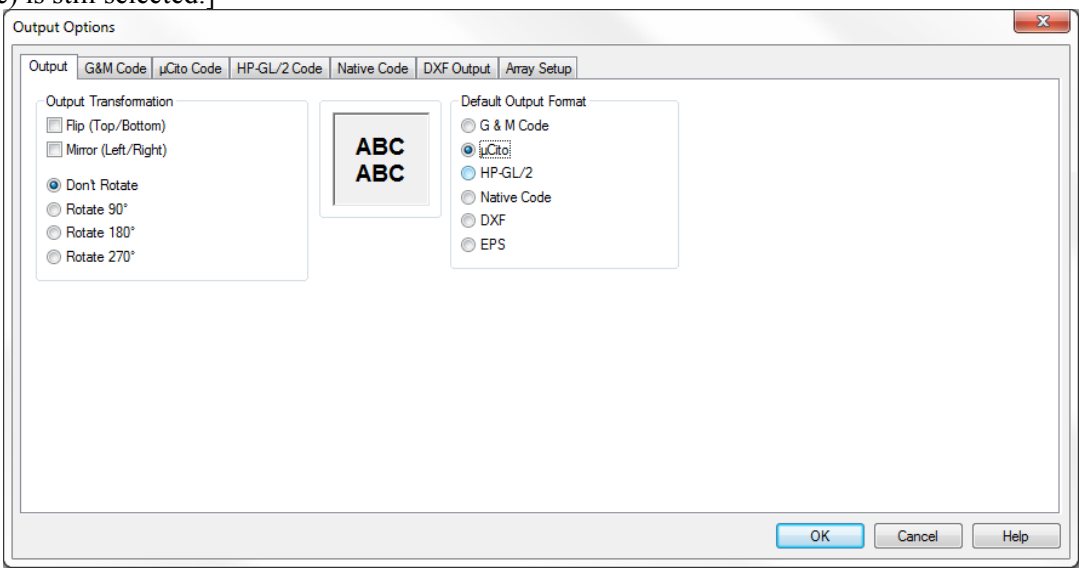
Operators of the 3000 Series WaterJet can utilize the NC GeoMate software as a post processor to create and edit machine cutting programs for a cleaner and more accurate cut. The following directions describe how operators can use NC GeoMate to set up the tool diameter (kerf) and modify existing files for improved output production.

1. Open NC GeoMate.

2. Select Options > Output Options.

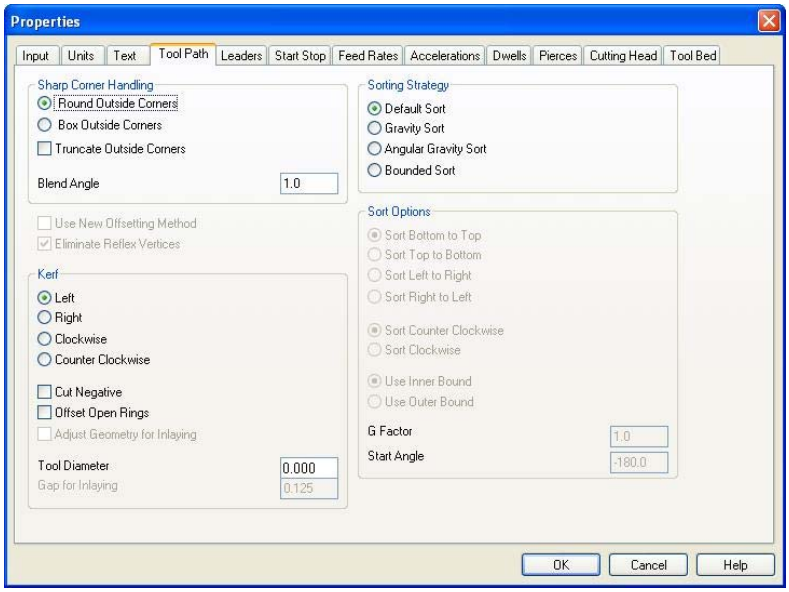


3. Change the Default Output Format to µCito and select *OK*. This will close the Output Options dialog. [Once this is set the first time, operators may skip this step or just complete this step to verify that µCito (i.e., *.uc) is still selected.]



The µCito file type is preferred for MultiCam WaterJets because it allows for precision acceleration and deceleration control of the tool tip for the best possible part finish.

4. Select Options > Properties and click on the Toolpath tab. From this page, operators may adjust the actual kerf by changing the value of the Tool Diameter. The Tool Diameter value will offset the toolpath by half the total kerf.

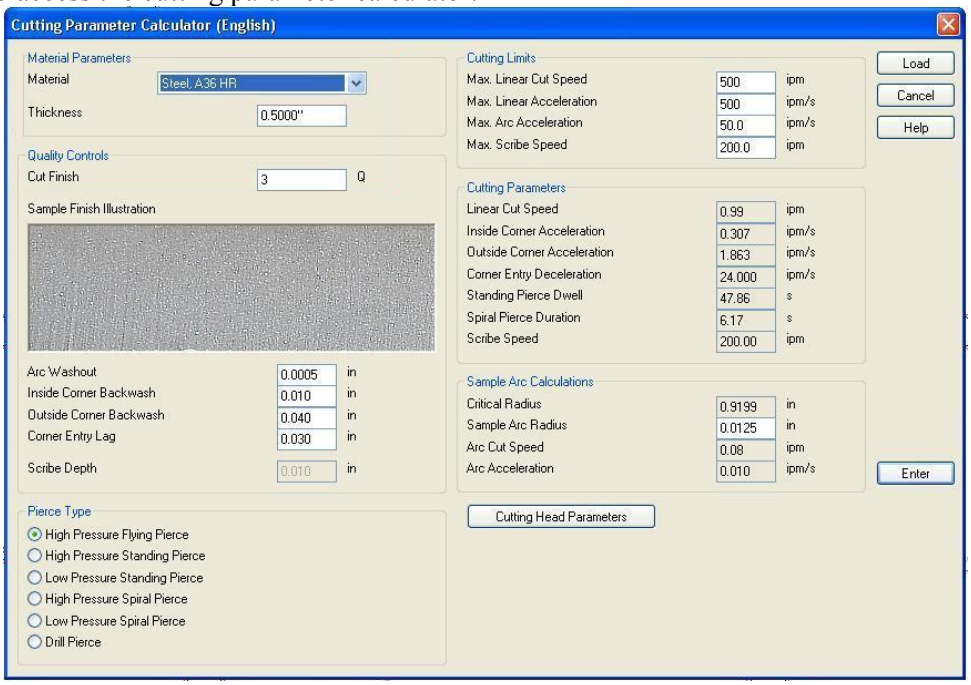


5. Change the tool diameter of the kerf to the size of the focus tube* (e.g., 11/30 will have a focus tube size of 0.030) and select *OK*.

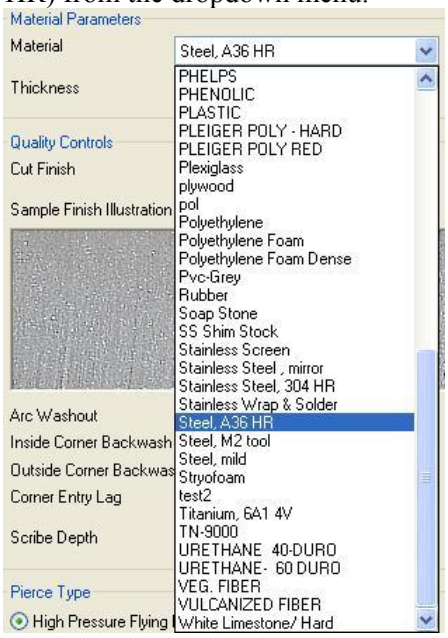
* The operator can choose to set the tool diameter to 0.000 in order to determine the exact distance needed to modify the tool diameter. Using the size of the focus tube is a recommended starting point.

6. Load a test square file from C:\Program Files\Winter City\NC Geomate\Samples\1insq.dxf. The test square measures 1" (25.4mm).

7. Click on to access the cutting parameter calculator.



8. Select the material (e.g., Steel, A36 HR) from the dropdown menu.



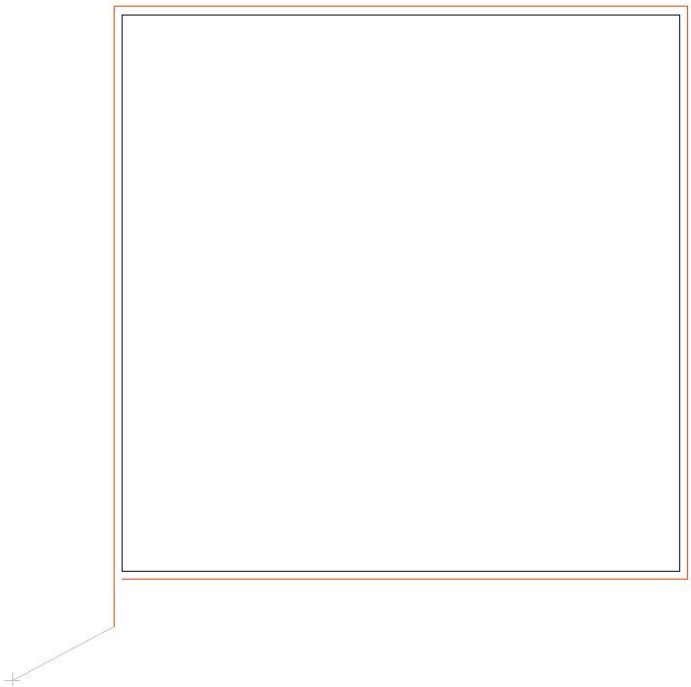
9. Adjust the thickness as needed (e.g., 0.5000”).

10. Adjust the finish as needed (e.g., 3). The finish quality is expressed as 1 – 5 with 1 being rough and 5 being fine.

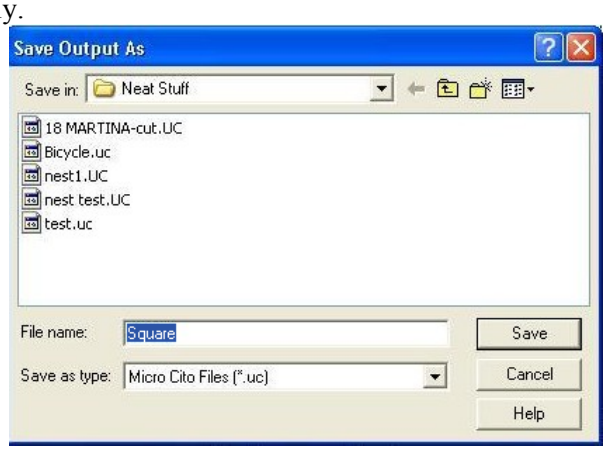
11. Set the pierce type (e.g., High Pressure Standing Pierce).

12. Select Enter and then select Load.

13. Click back onto the main GeoMate dialog and check the toolpath.
    a. Click on to enable extra icons for toolpathing. The toolbar will expand.
    from
    to
    b. Click to play the file from the beginning.
    c. Click on and to review the cutting sequence during the play.

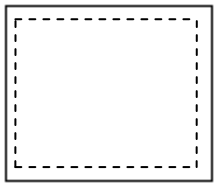


14. Click and save the output drawing to DNC. The file type should be Micro Cito Files so that the file can be accessed from the keypad. If the default output format is not also in µCito (see step #3 above), then the file will not process properly.



15. Load the drawing from the keypad, cut the 1" (25.4mm) square, and measure the dimensions. The tool diameter entered will affect the final distance of the sides.

- If the sides **measure less** than 1" (25.4mm) (e.g., 0.97") long, then add that value to the tool diameter.
- If the sides **measure more** than 1" (25.4mm) e.g., 1.01") long, then subtract that value from the tool diameter.

Actual Cut is too short.	Actual Cut is exact.
	
———— Design Cut - - - - - - - Actual Cut	———— Design Cut - - - - - - - Actual Cut

16. Check and possibly adjust the kerf value. This test should be completed at the beginning of each 8-hour shift.

Once the kerf has been corrected, operators may **repeat steps #7 – 14 to create a new cut file.**

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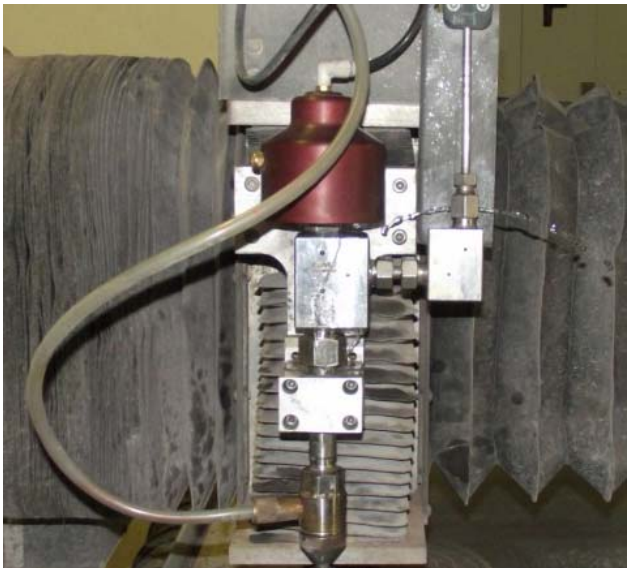
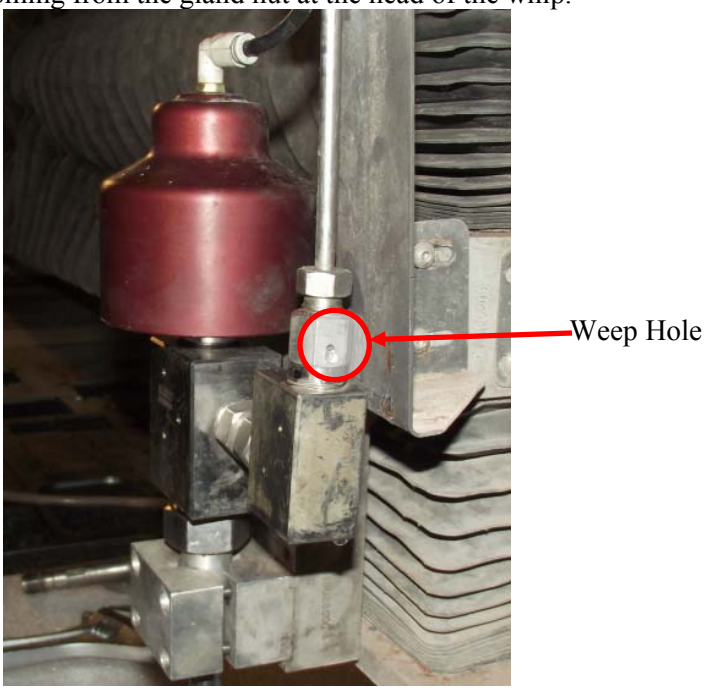
Fixing a Leak on a 3000 Series WaterJet

Operators of the 3000 Series WaterJet might encounter water leaks during the setup or operation procedure, and most of these leaks can be easily fixed by tightening the gland nut fitting closest to the leak. An example leak fix at the abrasive cutting head is described below.

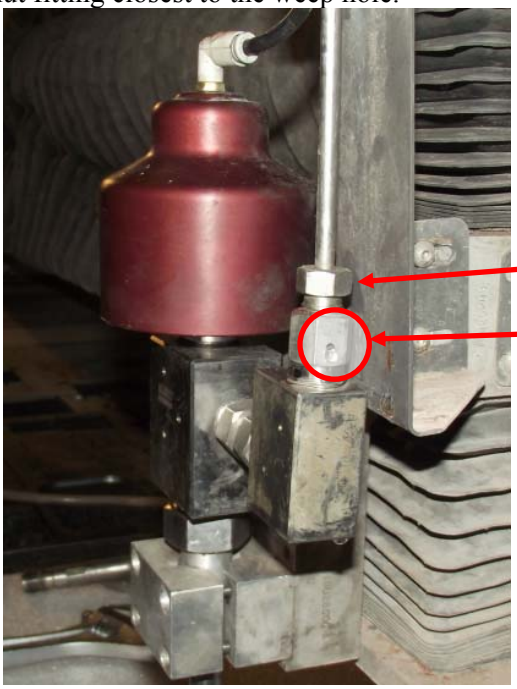


1. Identify the location of the leak. The gland nut fittings along the whip are equipped with weep holes. In this case, the leak is coming from the gland nut at the head of the whip.



2. Turn the inlet water off. Even if the intensifier is OFF, water will still run through the whip if the inlet water is not also turned off.

3. Locate the gland nut fitting closest to the weep hole.



4. Use 2 wrenches to hold the whip in place and tighten the gland nut fitting.

5. Turn the inlet water back on.

- If water is still leaking, check for any leaks at weep holes along the path of the whip and repeat the above procedure.
- If the water is still leaking after a second completion, then call Technical Support.

Fast Starts

Changing Cutting Nozzles

WaterJet operators may use the abrasive cutting capabilities of their system for most cutting sequences, but some materials like foam do not need abrasive. Operators may choose to use pure water cutting instead and will need to change the cutting assembly. The following directions describe how an operator can remove the abrasive cutting head, install a pure water cutting head, and purge possible contaminant from the newly installed assembly.

Removing Abrasive Cutting Nozzle

1. Hard Home the machine.

2. Turn the Pump Running switch to the OFF position.

3. Turn the inlet water off. Even if the intensifier is OFF, water will still run through the whip if the inlet water is not also turned off.

4. Turn the Head 1 Jet switch from OFF to ON and allow water to spray out. This will relieve pressure from the system and unseat the pin inside the pneumatic control valve.

5. Lay down a clean work piece spoilboard onto the table

6. Remove the abrasive tube and set aside.

8. Remove the abrasive head (Left Hand Threads = right to loosen [opposite from normal bolt thread]).

9. Loosen but do not remove the 4 bolts of the abrasive head clamp assembly.

10. Hold the pneumatic control valve still and loosen the gland nut. It is recommended that 2 wrenches be used for this step.

11. Allow time for any water in the pneumatic head to release.

12. Remove the 4 bolts of head clamp assembly and set aside. These bolts will be used later.

13. Remove the nozzle tube from the pneumatic control valve.

Installing Pure Water Nozzle Assembly

1. Verify Head 1 Jet switch is still set to ON.

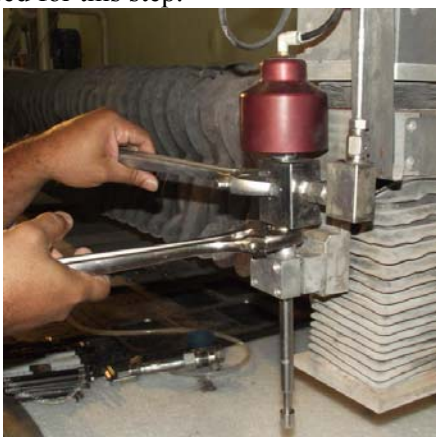
2. Remove any old lubricant off of the pure water nozzle tube with a cleaner like WD40 or Simple Green. Residual lubricant or abrasive on the nozzle tube may cause leaks in future operations.

3. Apply anti-seize goop to the threads and spread the goop across the metal threads on the nozzle tube. This will prevent the metal-to-metal threads from locking.

4. Screw the actuator high pressure valve seat and the nozzle tube into the pneumatic control valve.

5. Snug the 4 bolts of the head clamp assembly.

6. Hold the pneumatic control valve still and tighten the pure water head assembly in place. It is recommended that 2 wrenches be used for this step.



7. Tighten the 4 bolts of the head clamp assembly once entire assembly is in place.

Purging Possible Particulate from Newly Installed Assembly

1. Remove the nozzle nut and orifice (Left Hand Threads).

2. Turn Head 1 Jet switch to OFF.

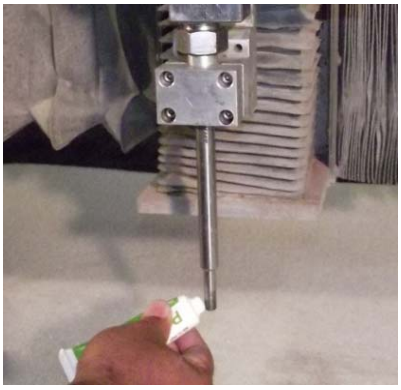
3. Rotate Pump Running from OFF to START. The switch will spring back to ON, and the pump will begin pressurizing the water.

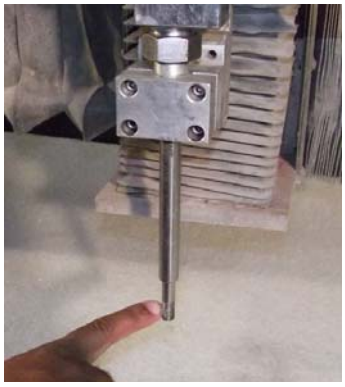
4. Turn the inlet water on, turn Head 1 Jet switch to ON for one second and then turn to OFF, and repeat 3 or 4 times or as needed. This will manually purge the high pressure line to clear any potential contaminants or metal shards.

Water will flow through the cutting head and carry with it any contaminants or metal shards.

5. Remove any old lubricant off of the threads of the pure water nozzle tube with a cleaner like WD40 or Simple Green.

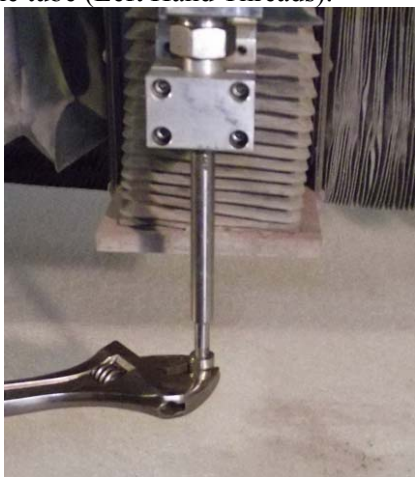
6. Apply anti-seize goop to the end of the nozzle tube. This will prevent the metal-to-metal threads from locking.



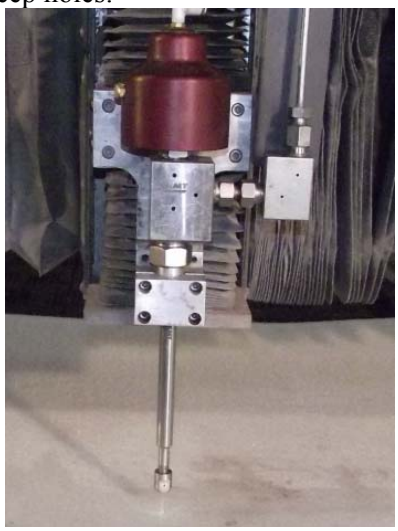


7. Insert the orifice into the nozzle nut so that the stem of the orifice is facing down.

8. Tighten the pure water nozzle head onto the bottom of the tube (Left Hand Threads).



9. Test pressurized water flow through the nozzle by turning Head 1 Jet switch to ON. Operators should use this time to check for any leaks at weep holes.



Squaring the Table

The table squaring procedure should be completed when the ***MultiCam*** machine is first installed. Operators may need to resquare the table if a forklift hits the gantry or if the motors are changed. The following directions describe how to check the square of the table, change the square of the table, and verify the square of the table. Some helpful hints are also provided.

The required tools are as follows:

- Tape measure
- Cutting head prepared to mark material (e.g., V point cutter, permanent marker)
- Two people
- Calculator

Check the Square of the Table

1. Home the machine.

2. Install a V point cutter or permanent marker to the cutting head.

3. Jog the cutting head to the lower right corner of the table.

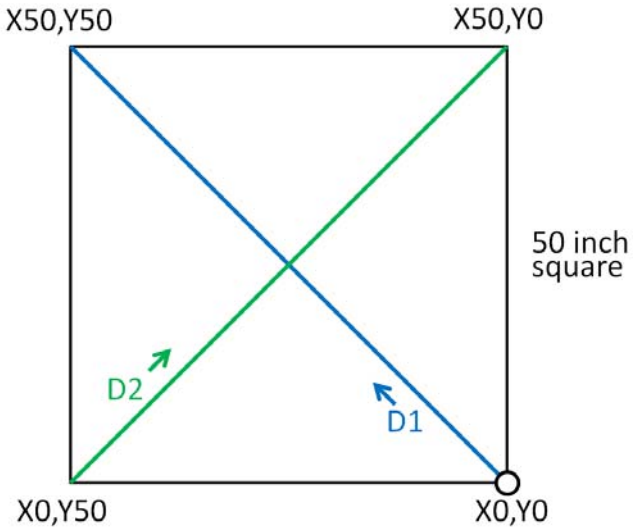
4. Press Set Home.

5. Jog the cutting head down in Z to make a small mark at X0,Y0.

6. Use the Move command on the keypad to exactly position the cutting head at the next corner of a large square and make another small mark.

7. Repeat step #6 until all 4 corners of the square have been marked [e.g., place marks at (0,0), (50,0), (50,50), (0,50)].

8. Measure the distance between the two diagonal points (D1 and D2) using the tape measure.
   - If the distances are the same, then the machine is square.
   - If the distances are different, then continue with **Change the Square of the Table**.



Change the Square of the Table

If D1 and D2 are different lengths, then the operator should use the following formula to correct the square value.

$$\frac{\text{Rail Distance}}{\text{Square Size}} \times \frac{\text{D1} - \text{D2}}{\sqrt{2}} = \Delta\text{X Square}$$

Rail Distance – center to center distance between gantry casting datums
Square Size – length of the sides of the square
D1 – the first diagonal distance (e.g. 0,0 to 50,50)
D2 – the second diagonal distance (e.g. 0,50 to 50,0)
ΔX Square – the amount added to or subtracted from the current X square value

Example:

$$\frac{62.25}{50.0} \times \frac{70.78 - 70.62}{1.41421} = 0.090$$

The calculated ΔX Square value of 0.090 would be added to the current X square value found in the flash parameter location 23.

Example:

Current X square (Param 23)	-0.050
Calculated ΔX Square	+ 0.090
New value for Param 23	+0.040

Verify the Square of the Table

After changing parameter 23 with the new value, the operator must make some additional changes to insure that the square of the table is correct.

1. Loosen the gantry casting bolts to allow the gantry to twist into its new position on the gantry castings.

2. Reboot the machine.

3. Hard home the machine and repeat **Check the Square of the Table**.

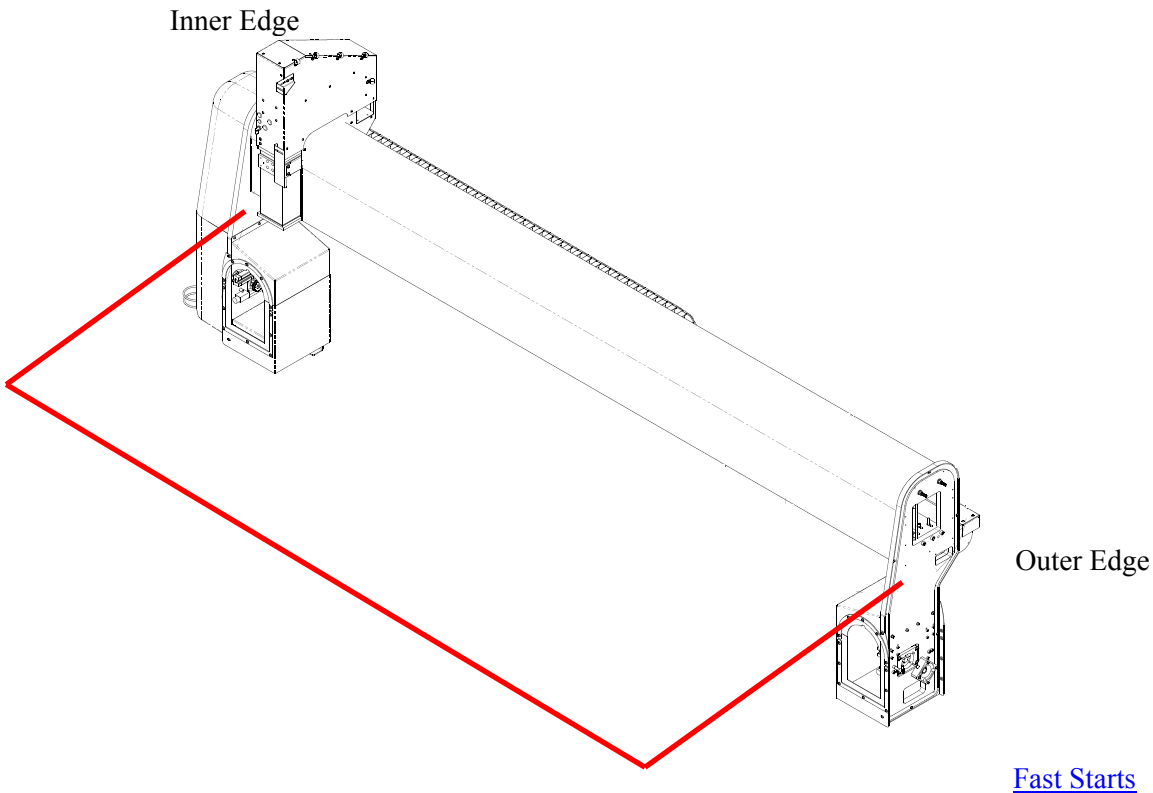
- If the distances are the same, then the machine is square. Operators should tighten the gantry bolts to lock the gantry into place on the gantry castings.

- If the distances are different, then repeat **Change the Square of the Table**.

Helpful Hints

- ❖ At least 2 operators should be involved when checking the square of the table.
- ❖ Operators should begin measuring from the 1” mark on the tape measure. This provides greater accuracy.
- ❖ The measurement will be more accurate if the square is larger (e.g., 50” square is better than 10” square).
- ❖ Accurately squaring the gantry to the machine may take more than one attempt.

The rail distance can be measured from the center of the XA gantry casting to the center of the XB gantry casting. Since it is often difficult to locate the exact center of the casting, operators usually start at the outer edge of one gantry casting and measure to the inner edge of the other gantry casting.



Fast Starts

Hints and Tips

The ***MultiCam*** WaterJets have a very powerful yet easy-to-use interface. Operators who understand their systems and learn the keypad functions can utilize their cutting systems in an efficient and productive manner. The following tips complement this knowledge and can be used to the operators' advantage. Any operator with additional helpful hints or tips should send an email to support@multicam.com so that the User Manual can be updated.

#1 Focusing on Safety

Safety glasses and Hearing protection should be **worn at all times** while operating the machine, and long hair should be **restrained with a cap or net** when near the machines. Operators should never leave the machine unattended during the cutting sequence, and labels should be observed at all times.

#2 Testing

When testing new processes or when learning new functions of the machine, use the Dry Run function.

#3 Recovering after Loss of Power

When Set Home (0,0) is pressed, the X,Y locations are stored in the controller's memory. If the system loses power, the job can be restored by returning to the last home and running Proximity Restart.

Power can be applied back to the machine by pressing Find Home to index the machine. When the machine has completed the find home function, the operator should press Return to Home 0 to move the machine back to the last home position and set home there before re-establishing the Set Surface (Z=0), Cut Height, Lift Height, and X,Y Feedrate. The Proximity Restart function can then be used to resume the file.

#4 Maintaining the Machine

The ***MultiCam*** WaterJet will produce consistent, accurate work as long as it is well-maintained. Maintenance for this system is easy, yet it should not be overlooked. Operators may refer to the maintenance chart for more detail.

All machines should be kept clean when not in use. The build-up of material on the system should be cleared daily with special attention focused on the gear rack and bearing rails.

All of the bearings should be greased **at least twice a month** based on an 8-hour work day. The bearings should be greased more often if the machine is in use more than 8 hours a day.

The Lead Screw Z-axis should be lubricated with a non-aerosol, silicon-based lubricant. Operators are cautioned **against** using the lithium grease provided by ***MultiCam*** when lubricating Lead Screws as this may lead to premature wear of the Lead Screw. Ball Screws, however, can be lubricated with lithium grease. The filters on the electronics enclosure should also be cleaned.

#5 Selecting the Proper Consumables

Sapphire orifices must be replaced every 3 to 4 days while diamond orifices can be replaced every 30 to 40 days. The quality of the work is about equal, though the prices differ dramatically.

Abrasive can wear away parts of the waterjet cutting head, so operators should routinely check the deflector shield at the end of the cutting head and the carbide steel of the tube. These parts will need to be replaced regularly depending on the use of the machine.

Operators who use an Abrasive Delay can reduce build-up in the orifice and around the cutting head by making sure the abrasive is never moving through the system without water. The Abrasive Delay will cause the abrasive to start after the stream starts and to stop before the stream stops during the cutting sequence.

Fast Starts

Contacting *MultiCam*

For Sales questions or concerns, please direct all necessary email correspondence to the following address:

sales@multicam.com

Customers with technical questions about their ***MultiCam*** equipment should refer to their User Manual first. Any caller with questions regarding an issue that is clearly defined in the manual will be directed back to the manual by the Service Technician.

If the customer is unable to find the answers in the User Manual, he or she may contact the regional Technology Center. When placing a service call, customers should include the model and serial number of the machine and the full name of the company.

Fast Starts

Maintenance

The ***MultiCam*** WaterJet will provide years of productive service if it is maintained properly. There are daily, weekly, monthly, quarterly, and yearly maintenance steps required for each machine based on a 40-hour work week. ***MultiCam*** recommends that any waterjet used in excess of 40 hours a week should have the maintenance schedule adjusted accordingly. Each auxiliary system has specific maintenance procedures that must be addressed in addition to the following maintenance procedures for the CNC machine.

Daily

The following tasks should be completed at the beginning of shift daily on the ***MultiCam*** WaterJet:

- Inspect bellows for rips
- Inspect water lines
- Inspect top works and high pressure fittings to verify no heat build-up
- Check abrasive level if applicable

Weekly

The following tasks should be completed at the end of shift weekly on the ***MultiCam*** WaterJet:

- Complete all daily tasks
- Clean the machine thoroughly and remove any excess grease grime
- Inspect the jewel orifice if applicable
- Check the slat and brick condition
- Inspect the E-chain
- Vacuum the filter on the control box

Monthly

The following tasks should be completed at the end of last shift monthly on the ***MultiCam*** WaterJet:

- Complete all weekly tasks
- Grease all the linear bearing cars
- Inspect the focus tubes and wear inserts
- Check the motor engagement
- Inspect the air filter

Quarterly

The following tasks should be completed at the end of last shift quarterly on the ***MultiCam*** WaterJet:

- Complete all monthly tasks
- Inspect and clean all connections
- Inspect the pump filter
- Recalibrate the abrasive feeder to verify proper distribution of abrasive during a specific time frame

Bi-Annually

The following tasks should be completed at the end of last shift bi-annually on the ***MultiCam*** WaterJet:

- Complete all quarterly tasks
- Change the hydraulic oil filter

Annually

The following tasks should be completed at the end of last shift annually on the ***MultiCam*** WaterJet:

- Complete all bi-annually tasks
- Flush the hydraulic oil tank
- Replace lead screw Z-nuts on all transmissions
- Replace or update compressors and air lines

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Maintenance Log

Date	*Support Personnel*	*Maintenance Performed / Recommendations*

Fast Starts

Warranty for WaterJets

MultiCam hereby warranties the electronics, motion controller, and motors of the waterjet, when properly used per the original design function, to be free of defects for a period of one (1) year from the date of shipment from ***MultiCam***. This warranty is provided to assure the initial purchaser that the machine and control units are free from defects in workmanship and materials. No responsibility for loss of machine time or work piece is expressed or implied. This warranty is valid to the original owner while in compliance with normal usage and the recommended maintenance as prescribed by the manufacturer. Failure to perform regularly scheduled maintenance and maintain the maintenance log will void this warranty.

If the electronics, motion controller, or motors of the waterjet are found to be defective during the applicable warranty period in accordance with the following specific procedure, ***MultiCam*** will, at its option, either repair or replace the parts at no charge. Replacement parts may be refurbished. All parts that are replaced shall become the property of ***MultiCam***. This warranty does not include the following items:

water filters	timing belts	hoses
tooling	dust brushes	items consumed in normal use

Also excluded from the warranty is any damage to the waterjet resulting from, but not limited to, shipping, accident, disaster, misuse, abuse, or any unauthorized modification of the product
MultiCam makes no other warranty or representation of any kind, express or implied, and all implied warranties of merchantability and fitness for a particular purpose with respect to the equipment are disclaimed.

Specific Warranties

WaterJet Cutting Head

See the manufacturer's warranty for the specific waterjet cutting head.

Intensifier Pump

See the manufacturer's warranty for the specific intensifier pump.

Limited Warranty Procedures

USA

Customers must first contact their local authorized ***MultiCam*** Technology Center to issue a purchase order, which is required for any parts that must be returned to ***MultiCam***. When replacement parts are shipped, an RMA number/tag will be included and must be prominently displayed on the outside of the return package as well as on the accompanying packing slip. All domestic parts must be returned within 30 days of the RMA being assigned. If any RMA is received after that time, then the received merchandise will not be accepted for return and will be scrapped or returned at the Distributor's expense. The customer assumes cost of shipment for returned items. ***MultiCam*** will not issue Call Tags for any machine part or equipment.

Outside the USA

Please contact the local ***MultiCam*** Distributor for specific instructions.

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Warranty Registration List

The following documents must be returned to ***MultiCam*** in order for the warranty to be registered. Some documents may not apply to every ***MultiCam*** operator.

* Intensifier Unit Warranty Card
* Abrasive Delivery System Warranty Card
* Cutting Head Warranty Card
* MultiCam CNC Cutting System Warranty Card

These documents should be faxed or mailed to ***MultiCam*** within 30 days of the machine delivery and installation with the machine model and serial number, as well as the company information, included in the correspondence.

Fax Number: (972) 929-4071

Mailing Address:

MultiCam
Attn: Warranty Registration
PO Box 612048
Dallas, TX 75261

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Keypad and Functions

top

Handheld Keypad 2
Emergency Stop (E-Stop) 3
Hot Keys for the WaterJet 3
- Go Home 4
- Feedrate Override 5
- Jog Z-axis 5
- Pause 6
- Set Surface 7
- Start 8
- Set Home 8
- Move 9
- Jog X- and Y-axes 10
- WaterJet Test 11
- Menu 11
- Material Library 12
- Shift 13
- DNC 13
- Bar Code 15
- Drive Enable 15
- Cancel 16
- Jog Speed 16
- Help 16
- Soft Homes 17
- Enter 18
- Find Home 18
- Park Z Up or Down 18
- Proximity Restart 19
- Return to Home 0 20
- Dual Head 21
- Park X High or Low 22
- Park Y High or Low 22
- Drive Disable 23
- Controller Information 24
- Execute Self Test 24
- Set Soft Homes 25

Advanced 26
Advanced Features 28
- Dry Run 28
- Rotate File 29
- Step and Repeat 30
- Bar Code Scanner 32
- Safety Mat 32
- Dual Start 33

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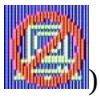
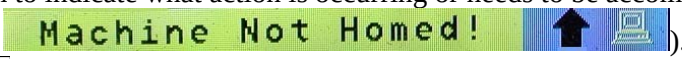
Handheld Keypad

The ***MultiCam*** graphical keypad provides more flexibility in accessing the WaterJet by allowing the operator to be closer to the work surface when setting up jobs. With the mobility of this unit, operators experience fewer problems pressing wrong keys by maintaining visual contact with the keypad. The display also allows for the standard 4 lines of text at the top of the screen to indicate the machine status as well as a graphical depiction of the cut file.

Shift Mode is indicated by the arrow at the bottom right (i.e., Normal Mode , Shift Mode).

The computer connection is also indicated at the bottom right (i.e., connected , not connected ). Text will appear at the bottom to indicate what action is occurring or needs to be accomplished before the cutting sequence can be started (e.g., 

). Operators may press the X-axis Down Jog Arrow

to view additional menu items in the various menus available on the keypad.

The keypad also provides direction with the color scheme: Blue keys indicate adjustments and settings; Green keys indicate action or movement; and the Yellow key indicates caution or pause. The Emergency Stop (E-Stop) red button located at the top of the keypad allows the operator to immediately shut down or discontinue the current job.

Keypad

Emergency Stop (E-Stop)

Pressing Emergency Stop (E-Stop) on either the handheld keypad or at the side of the gantry cuts power to everything except the control board of the machine, which will go into Emergency Stop mode. All job setup information is erased from the system, and operators should wait at least 2 minutes before engaging the machine and applying power to the motors. The E-Stop button must be pulled out when the main power switch is turned on.

Keypad

Hot Keys for the WaterJet

Hot Keys are the keys on the ***MultiCam*** Handheld Keypad which access functions without using the menu system. The operator can access different aspects of the system using the Hot Keys, which are listed under Normal Hot Key Functions and Shifted Hot Key Functions.

Normal Hot Key Functions *(as shown on keypad)*

Go Home	Feedrate Up	Jog Z Up	Not Used	Pause
Set Surface	Feedrate Down	Jog Z Down	Not Used	Start
Set Home	Move (7)	Jog Up (8)	WaterJet Test (9)	Menu
Material Library	Jog Left (4)	5	Jog Right (6)	Shift
DNC	Bar Code (1)	Jog Down (2)	Drive Enable (3)	Cancel (Exit)
Jog Speed	Help (+/-)	0	Soft Homes (.)	Enter

Additional hot key features can be accessed when the keypad buttons are pressed in combination with Shift .

Shifted Hot Key Functions

Find Home		Park Z Up		
		Park Z Down		Proximity Restart
Return To Home 0	Dual Head	Park X High		
	Park Y High		Park Y Low	
		Park X Low	Drive Disable	
	Controller Info	Execute Self Test	Set Soft Homes	

Keypad

Go Home

The Go Home function is a return to the current 0,0 Soft Home and Lift Height. The coordinates can be modified, but most operators prefer using soft homes for establishing different home coordinates during the cutting process.

Press Go Home .

Hot Keys Keypad

Feedrate Override

The Feedrate Override function allows the operator to adjust the X,Y travel of the machine and to change speeds from as little as 1% to as much as 100%. This affects the feedrate or cut speed when the cutter is moving through the material. The Feedrate Override has no effect when the machine is executing a rapid move above the material.

The cut speed will be shown on the keypad display as a percentage of the actual speed: *Feed%= ###*. The Feedrate Override determines the percentage by which the operator adjusts the cut speed.

1. Press Feedrate Override to adjust the feedrate in 1% increments when a file is being executed on the machine.
2. Hold Feedrate Override to adjust the feedrate in faster moving 1% increments when a file is being executed on the machine.

Hot Keys Keypad

Jog Z-axis

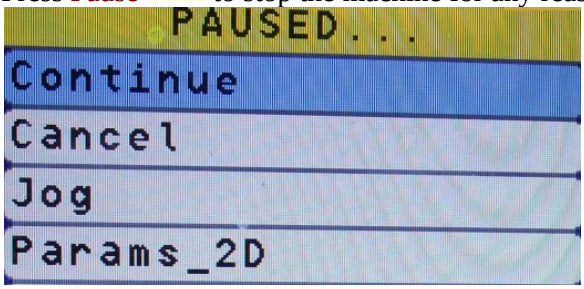
1. Press and hold Z-axis Up Jog Arrow or Z-axis Down Jog Arrow to raise or lower the waterjet cutting head.
2. Press Jog Speed to increase or decrease the Jogging speed of the head assembly.

Hot Keys Keypad

Pause

The Pause function allows the operator to instantly stop any motion of the machine or any file. The Z-axis will move to the Lift Height position, and the waterjet cutting head will shut off. At this point, the operator can change any 2D cutting parameters or Jog the head assembly out of the way to get a better look at the cut. When "Continue" is selected, the machine will automatically return to the position before Pause was activated and continue with the commanded motion or the file.

1. Press Pause to stop the machine for any reason.



2. Press Jog Arrows until the blinking cursor is over the first letter of the command to be executed.
   a. **Continue** finishes out the operation or file originally executed.
   b. **Cancel** ends the operation or file executed and shows *Motion Cancelled...* on the keypad display.
   c. **Jog** allows the operator to Jog the machine to any location within the table parameters.
   d. **Params_2D** allows the operator to make any quick changes in the 2D cut parameters.

3. Press Enter to accept the command.

Hot Keys Keypad

Set Surface (Z=0)

The Set Surface function allows the operator to identify and set the surface of the material or the software Z reference point as the Z-axis Home (Z=0). Once set, the surface will not have to be reset unless the system is shut off or the material thickness changes.

1. Make sure the material is stationary. Operators may choose to purchase a cutting table from ***MultiCam*** or may create their own cutting tables, and material may be clamped to the table or held in place by the weight of the material.
2. Press Jog Arrows to position the **center of the waterjet cutting head** anywhere over the material.
3. Press Set Surface .

4. Press Z-axis Jog Arrows until the head assembly is just above the material. Operators may choose to use a small spacer to prevent the waterjet cutting head from crashing into the material.
5. Press Enter to set the surface.

Hot Keys Keypad

Start

Pressing Start will begin a job file or execute a Cut Utility. When a file has been completed, the operator can press Start to activate the replay buffer and begin the file again. Operators should never leave the machine unattended during the cutting sequence.

Hot Keys Keypad

Set Home (0,0)

The Set Home function allows the operator to identify the exact location of X=0, Y=0 on the material to be cut. This is the Soft Home location 0. The file that is to be executed on the table will use this location as the software reference point home or origin (0,0): the machine will begin and return to this new origin, and the X and Y coordinate locations are stored in the controller's memory.

The location of the Set Home position will be the new origin (0,0) until a new home is set or the current home is cleared by selecting CLR_HOME from the menu system. The software reference point **must be** the material home point.

1. Press Jog Arrows to place the **center of the waterjet cutting head** over the front right corner of the material.

2. Press Set Home .

3. Press Enter to accept. This will store the absolute X and Y coordinate locations in the controller's memory.

Hot Keys Keypad

Move

The Move function allows the operator to enter exact values for X, Y, or Z (0,0,0) where the first entry is X (length), the second entry is Y (width), and the third entry is Z (height). The X, Y, and Z values will reference from the Hard Home position until the Set Home and Set Surface functions have been selected. At that point, the X- and Y-axes will reference from the Set Home position. The Z value will reference from the surface of the material.

1. Press Move

.

2. Enter the desired value for X from the number keypad (e.g., 4.0).

3. Press Enter to accept the value.

4. Enter the desired value for Y from the number keypad (e.g., 4.0).

5. Press Enter to accept the value.

6. Enter the desired value for Z from the number keypad (e.g., 0.0).

7. Press Enter to accept the value.

8. Press Enter when the "?" is displayed to accept all settings and move the machine to the new coordinates.

9. Press Cancel to return to the main display.

The Move function can also be used to verify a specific location.

1. Press Move

.

2. Press Enter 3 times to verify the current location of the X-, Y-, and Z-axes.

   The operator should press Enter to keep the axis value from changing when that value is shown on the screen.

Hot Keys Keypad

Jog X- and Y-axes

The Jog Arrows

are used to Jog the location of the waterjet cutting head and to move through the menu. Jog Speed can be pressed to change the Jogging speed of the machine.

1. Left Arrow

is the Y-axis Positive Jog Key and Left Scroll Key in the menu.

2. Up Arrow

is the X-axis Positive Jog Key and Line Up Key in the menu.

3. Down Arrow

is the X-axis Negative Jog Key and Line Down Key in the menu.

4. Right Arrow

is the Y-axis Negative Jog Key and the Right Scroll Key in the menu.

Hot Keys Keypad

WaterJet Test

The WaterJet Test function allows the operator to test the waterjet valve, abrasive feed, and pressure of the waterjet. Operators should run the waterjet test periodically to make sure the system is working properly.

1. Press WaterJet Test

to access the WaterJet test.

   a. **1** tests the Jet Valve. If water is connected and flowing, a jet of water will shoot through the nozzle.
   b. **2** tests the Abrasive injector. Abrasive is fed into the water flow.
   c. **3** toggles the pressure of the Intensifier.

2. Press each number to toggle between ON and OFF for the jet valve and abrasive tests and between HIGH and LOW for the pressure test. The screen will show the current status.
3. Press Cancel to exit the test and return to the main display.

Hot Keys Keypad

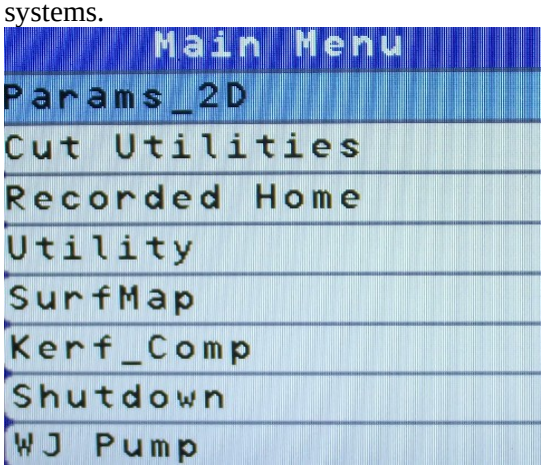
Menu

Menu items help the operator handle many of the functions of the ***MultiCam*** WaterJet by providing the ability to set feedrates and other parameters, run tests, and cut basic shapes. With the addition of some advanced features of the ***MultiCam*** WaterJet, the operator can handle changing material surfaces.

1. Press Menu

to access the menu system.
2. Press Jog Arrows

until the blinking the cursor is over a specific menu item. Certain menu items will then pull up a sub-menu with more selection. Not all menu items will be applicable for some systems.



Hot Keys Keypad

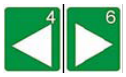
Material Library

The Material Library function allows operators to review the preset parameters for various materials. Operators may select the material type, material thickness, and cut finish, and the parameters will be automatically retrieved from the integrated database and stored in Params_2D to provide a starting point. Any adjustments can be made to suit the operating conditions.

1. Press Material Library .

2. Press X-axis Jog Arrows to position the cursor over the appropriate selection (e.g., Aluminum).

3. Press Enter to access the material.

4. Press Y-axis Jog Arrows  to position the cursor over the parameter to be changed (i.e., THICKNESS, FINISH).

5. Press X-axis Jog Arrows to change the value.

6. Press Enter to accept the changes and return to the main menu. The material, thickness, and finish will be displayed.

Hot Keys Keypad

Shift

Pressing Shift before pressing any desired Hot Key will allow the operator to toggle between **Normal Hot Key** and **Shifted Hot Key** functions.

When Shift has been pressed, the Shift LED will illuminate to indicate that the keypad is now in *Shifted Mode*.

Hot Keys Keypad

DNC

The Distributed Numerical Control (DNC) function allows the operator to access files directly from the hard drive of the host PC by using the keypad at the machine. This allows the computer and the machine to be in different locations, which frees up the operator to view the progress of the cutting sequence. Additional information on DNC can be found in the Software Section of this manual, along with JobNameServer, the interface between the computer and the ***MultiCam*** WaterJet.

1. Make sure that JobNameServer has been activated on the computer before selecting this function.

2. Press DNC .

   The keypad will display a list of the directories in the DNC path after the system has validated and verified.

3. Press Jog Arrows to move the blinking cursor over the directory to be entered.

4. Press Enter . The keypad will display the DNC files that are available in that directory, and directories or folders and any associated subfolders are displayed between brackets [ ]. Press Enter while the blinking cursor is located over the 2 decimal points at the beginning of the directory to return to the list of directories if necessary.

5. Press Jog Arrows to move the blinking cursor over the first letter of the file to be executed.

   Z-axis Jog Arrows will page up or down one screen at a time, while X-axis Jog Arrows will move up or down one line at a time.

6. Press Start .

   If the operator just presses Enter over the blinking cursor, he or she will only receive a display of the file name, size, and date/time created.

7. Press one of the following Hot Keys to execute the required command or press X-axis Down Jog Arrow once to access the Dry Run function and once more to access the Step and Repeat function.

   a. Start will execute the selected job file.

   b. Cancel will end the selected job file.

   c. Pause will allow the operator to make changes while holding the file in queue.

   Once the file has completed running, the keypad display will show how long the selected file ran and will automatically return to the directory.

Hot Keys Keypad

Bar Code

The Bar Code function allows the operator to scan a label with the bar code scanner, which will automatically call up and download the correct job for execution on the machine, and is an option on ***MultiCam*** WaterJets. In addition, ***MultiCam*** provides JobPreviewer to print bar code labels and tool path previews with operator notes. The Bar Code Scanner is limited to 48 characters excluding the initial DNC path that is set up in JobNameServer (e.g., C:\DNCfiles\).

1. Press Bar Code to execute the Bar Code function. This will set the display to show when the system is bar code ready.

2. Depress the trigger on the bar code scanner and scan the bar code label printed on the JobPreviewer sheet.

   Example Only:

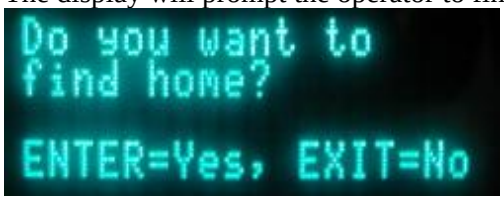
3. Press Start when prompted to begin the job.

Hot Keys Keypad

Drive Enable

1. Press Drive Enable to enable all Servo Drives after a system error.

   The display will prompt the operator to find home after re-enabling the motor drives.



2. Press Enter to ensure proper machine operation.

Hot Keys Keypad

Cancel

Press Cancel to cancel or exit any selected function or menu item. In some cases, this needs to be pressed twice to make sure the function has been completely canceled. Hot Keys Keypad

Jog Speed

Press Jog Speed to toggle between 3 different speeds at which the machine can Jog the ***MultiCam*** WaterJet. The keypad display will prompt the operator with *Jog= FAST, MED,* or *SLOW*. These words show the rate at which the machine will Jog. Hot Keys Keypad

Help

The Help function allows the operator to learn the functions of any Hot Key selected. There are 2 modes of the Help function: *Normal* and *Shifted*. In *Normal* mode, the operator can review the standard function of any Hot Key on the display. In *Shifted* mode, the operator can review the second or shifted function of that key on the display.

1. Press Help to access the Hot Key Help Feature.

2. Press any key for a brief description of that key in *Normal* mode.

3. Press Shift and any key for a brief description of that key in *Shifted* mode.

4. Press Cancel twice to exit help. Hot Keys Keypad

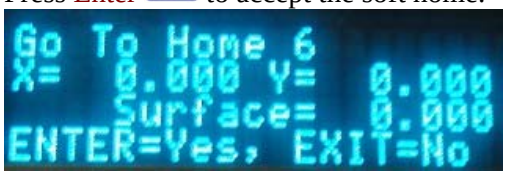
Soft Homes (.)

The Soft Homes function allows the operator to have multiple fixture setups to be quickly accessed during the cutting procedure. This button also allows the operator to input a decimal into a numeric value.

1. Press Soft Homes .

2. Enter the appropriate number (1-9) to assign the proper value for the new home position (e.g., 6).

3. Press Enter to accept the soft home.



The display will acknowledge that the particular home position has been selected.

4. Press Shift and Soft Homes to set new Soft Home locations.

Hot Keys Keypad

Enter

Press Enter to accept functions, settings, and menu items as directed.

The display may provide a question mark "?" when processing certain functions. The operator can press Enter to verify that the action should take place. Hot Keys Keypad

Find Home

The Find Home function allows the operator to return each axis to the machine home position in order to relocate the homing targets. The waterjet cutting head will move to the right front of the table and index all X, Y, Z components starting with the Z-axis.

1. Press Shift and Go Home to index the gantry, carriage, and Z assembly off of the limit switches after one of the following actions have been completed:
   a. The machine has just been turned on.
   b. The machine has stalled or lost its position coordinates.
   c. The machine has been stopped because the operator pushed in E-Stop.

2. Refer to the display as it will indicate when the system locates the targets for each axis. The drive will be enabled when the Find Home function has been activated. Hot Keys Keypad

Park Z Up or Down

The Park Z function will move the waterjet cutting head to either the absolute Z=0 position or all the way up.

1. Press Shift and Z-axis Up Jog Arrow to raise the head assembly to the absolute Z=0 position.

2. Press Shift and Z-axis Down Jog Arrow to lower the head assembly to the Lift Height position.

Hot Keys Keypad

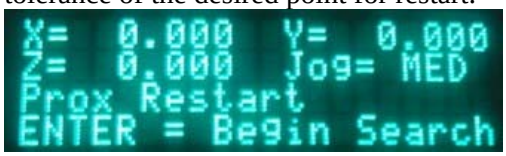
Proximity Restart

The Proximity Restart function is an advanced feature that allows the operator to begin a file by locating the end position based on the original Home location. The controller will search through the file to locate the nearest point and base the coordinates of the restart on the Home position from where the file was originally executed.

Proximity Restart is used any time a file is interrupted and restarting the entire file is not practical. The operator can return to the original Home position to restart the program as the configuration is based on where the cutter stopped in relation to where the cutter originally began. This command will function through the internal replay buffer of the machine.

1. Press Shift and Start from the Home position where the file was originally executed.

2. Press Jog Arrows to move the waterjet cutting head to a position within the restart tolerance of the desired point for restart.



3. Press Enter to begin the search.

   The keypad display will indicate the coordinates when a point within the restart tolerance is found. If no points are located within the restart tolerance, the system will default to the main display. At this point, the operator should repeat the Proximity Restart process.

4. Press Start to restart the file at the current location or press the X-axis Up Jog Arrow to access the closest point in the file. WaterJets can begin just before the last cut location.
   a. If the point is located over a Tool UP Move, follow the keypad display and repeat step 3.
   b. If there is a power failure, the operator will need to re-index the machine and reset Surface and Max Depth.

Hot Keys Keypad

Return to Home 0

The Return to Home 0 function will return the waterjet cutting head to the last recorded set Home position or Soft Home location 0. If power has been lost or the machine was rebooted, Home 0 will become the new Hard Home.

Press Shift and Set Home .

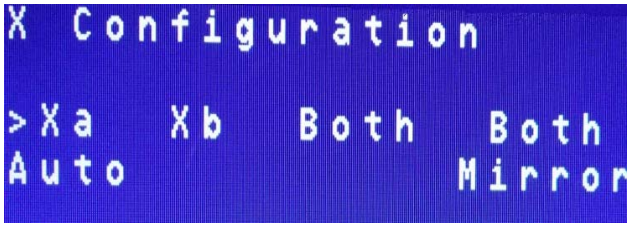
When the Home position has been reached:

Hot Keys Keypad

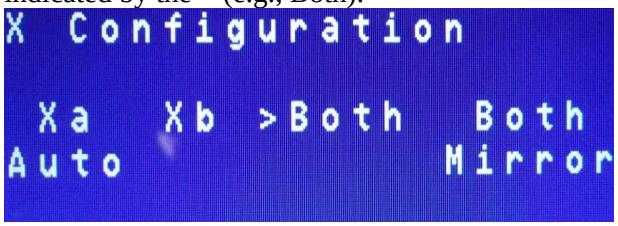
Dual Head

The Dual Head function allows the operator to select the configuration mode for operation. This function is only available on machines with dual cutting heads. Operators will also need to set the Yb Offset from the main menu to utilize this function.

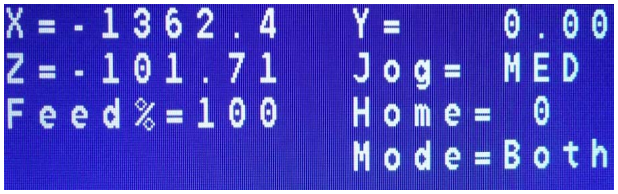
1. Press Shift and Seven.



2. Press Y-axis Jog Arrows to move between the configurations. The active configuration will be indicated by the > (e.g., Both).



3. Press Enter to select the configuration (e.g., Both). The selected configuration mode will be shown on the main screen.



Hot Keys Keypad

Park X High or Low

The Park X function will move the waterjet cutting head and gantry assembly to a set park position that could be as far away as the maximum length of the table or all the way back in X-axis. This allows the operator to reload material on the table or examine work without interference from the head assembly.

1. Press Shift and X-axis Up Jog Arrow to move the head and gantry assembly to the high or farthest set park position.

2. Press Shift and X-axis Down Jog Arrow to move the head and gantry assembly to the low or closest set park position.

Hot Keys Keypad

Park Y High or Low

The Park Y function will move the waterjet cutting head and gantry assembly the maximum length of the gantry to the right or left in Y-axis. This allows the operator to examine the work without interference from the head assembly.

1. Press Shift and Y-axis Left Jog Arrow to move the head and gantry assembly to the left side of the gantry.

2. Press Shift and Y-axis Right Jog Arrow to move the head and gantry assembly to the right side of the gantry.

Hot Keys Keypad

Drive Disable

The X-, Y-, and Z-axis drives will be disabled in the event of a system failure or a mechanical obstruction to prevent possible damage to the individual drives. The operator also has the ability to disable the drives from the keypad. Once the drives have been disabled, the machine cannot be operated by using the keypad.

Press Shift and Drive Enable to disable all drives.

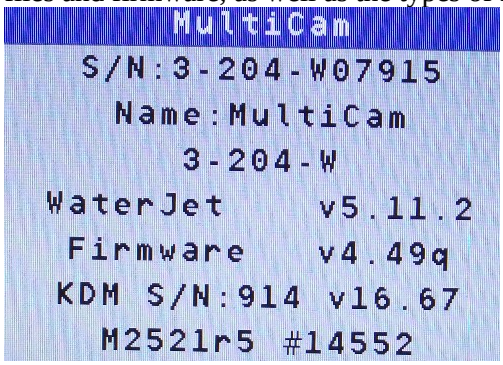
When the drives associated with servo systems are disabled, the power to the motors is also disabled. The motors associated with stepper systems still have power after the drives are disabled, but there is no output from the control board.

Hot Keys Keypad

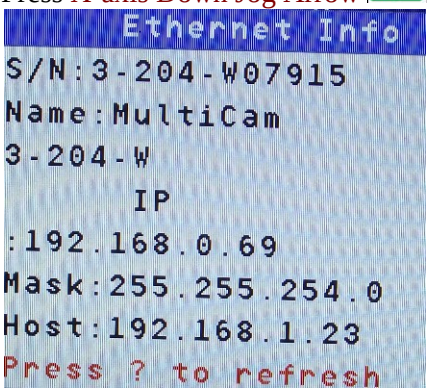
Controller Information

The Controller Information function provides information on the software loaded in the controller.

1. Press Shift and Help to display the controller information. This includes the version of machine Init files and firmware, as well as the types of Interface and Control boards.



2. Press X-axis Down Jog Arrow to access Ethernet information.



3. Press DNC to change the IP address if necessary.

Hot Keys Keypad

Execute Self Test

Press Shift and Zero to access the self test, which runs a diagnostic on the following:

- Verifying Memory
- Cutting a Rectangle
- Testing the Origin (Home)

Hot Keys Keypad

Set Soft Homes

The Set Soft Homes function allows the operator to establish 9 programmable Soft Home positions to record multiple Home positions that can be used in supporting multiple cutting fixtures. These homes stay recorded in memory even after power has been removed from the system.

1. Press Jog Arrows to position the **center of the waterjet cutting head** where the new Soft Home location should be set.

2. Press Jog Speed to change the Jogging speed if necessary.

3. Press Shift and Soft Homes .

4. Enter a number between 1 and 9 using the number keypad (e.g., 3). If the operator wants to save the Z value in the Soft Home, he or she should contact a ***MultiCam*** Technician for assistance.

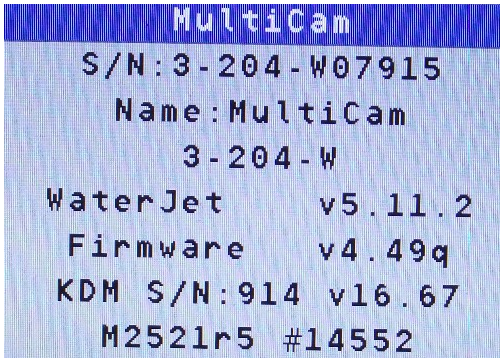
5. Press Enter to record the new Soft Home.

Hot Keys Keypad

Advanced

Advanced Hot Keys are accessed by pressing Shift, Help, and any of the keypad numbers. The operator will begin in the main information screen.

Main Information Screen

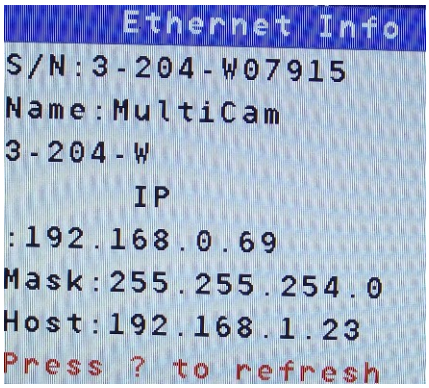


"MultiCam"
Serial Number of the Machine
Machine Name
Machine Size

Init File Version
Firmware Version

Keypad Type and Serial Number
Board Type and Serial Number

Ethernet Information Screen



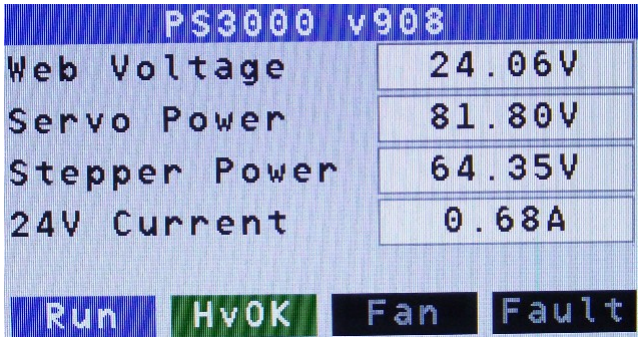
"MultiCam"
Serial Number of the Machine
Machine Name
Machine Size

IP Address
Net Mask
DHCP Server Address (only shows if DHCP enabled)

"Press ? to refresh"

Press DNC from this screen to be prompted to enable DHCP or specify an IP address.

Power Information Screen

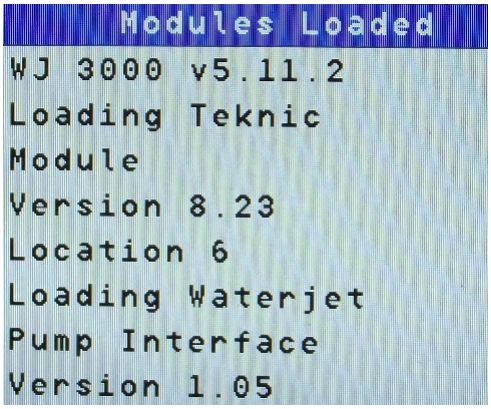


Power System and Version

Web Voltage
Servo Power
Stepper Power
24V Current

Power Status

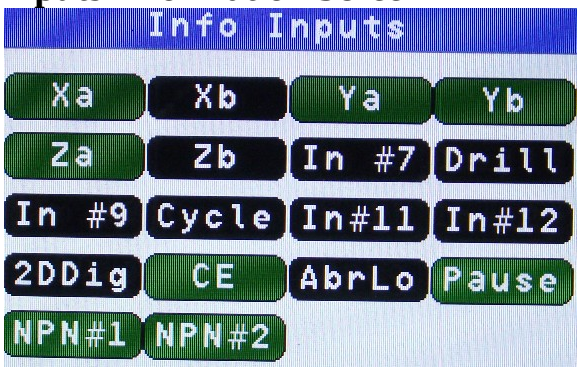
Modules Loaded Information Screen



"Modules Loaded"

Module Name and Version
Module Version
Module Location

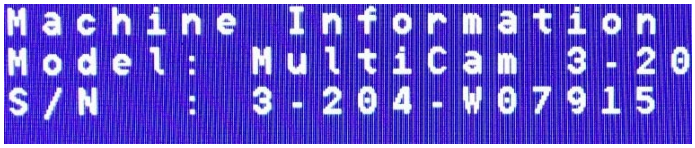
Inputs Information Screen



Each box shows the status of the specific input.

- Dark = off
- Bright = on

Machine Information Screen



"Machine Information"

Model Name
Serial Number

Keypad

Advanced Features

Advanced Features help the operator to be more productive previewing a file before cutting the material with Dry Run, rotating a file to match the angle of the sheet with Rotate File, cutting an entire sheet of shapes using the Step and Repeat function, accessing the bar-coded information with the Bar Code Scanner, and using Safety Mat as an option for pausing the cutting sequence. Some systems are also available with Dual Start, an option to maximize the cutting time by creating 2 separate work areas on the same machine.

Keypad

Dry Run

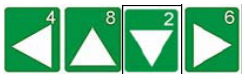
The Dry Run function is an advanced feature that allows the operator to preview the file to be cut. The file will run at full speed, but the system allows the operator to slow down the Dry Run process by leaving the feedrate override active. The head assembly will stay in the Tool UP position, never entering the material. The keypad displays *Tool 1 Up* when the cutter would normally be in the UP position moving between contours. The keypad displays *Tool 1 Down* when the cutter would normally be in the material cutting the contours. This command will function through the DNC or through the internal replay buffer of the machine.

1. Make sure that JobNameServer has been activated on the computer.

2. Press DNC . The keypad display will show a list of the directories in the DNC path.

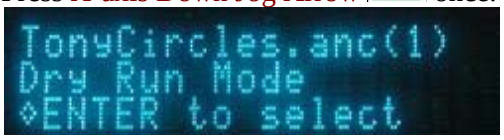
3. Press Jog Arrows until the blinking cursor is over the directory to be entered.

4. Press Enter . The keypad will display the DNC files that are available in that directory, and directories or folders and any associated subfolders are displayed between brackets [ ]. Press Enter while the blinking cursor is located over the 2 decimal points at the beginning of the directory to return to the list of directories if necessary.

5. Press Jog Arrows  until the blinking cursor is over the first letter of the file to be executed.

6. Press Start .

7. Press X-axis Down Jog Arrow once.



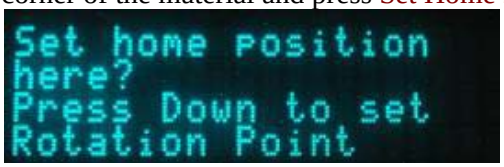
8. Press Enter to start the Dry Run process. The operator can press Cancel to abort the selected job file or Pause to make any changes while holding the file in queue.

Advanced Keypad

Rotate File

The Rotate File function is used to rotate the program to match the material. Operators may find it impractical to square material sufficiently when heavy materials are loaded onto the table, so this function allows the machine to adjust the parameters of the job file.

1. Press Jog Arrows to position the **center of the waterjet cutting head** over the rear right corner of the material and press Set Home .



2. Press the X-axis Down Jog Arrow to set the Rotation Point. The keypad will briefly display the rotation setting and then switch back to the main display.

3. Press Start to begin the job file. The operator will be prompted to accept or reject the rotation when the execute key is pressed.

Advanced Keypad

Step and Repeat

The Step and Repeat function is used to make a single job file cut multiple times. Operators can program a single part of the cutting sequence and include the size of the material to be cut without having to create a larger file with a detailed description of parts and motions.

1. Make sure that JobNameServer has been activated on the computer.

2. Press DNC . The keypad display will show a list of the directories in the DNC path.

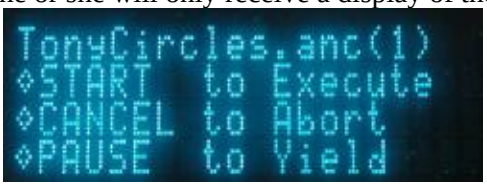
3. Press Jog Arrows until the blinking cursor is over the directory to be entered.

4. Press Enter . The keypad will display the DNC files that are available in that directory, and directories or folders and any associated subfolders are displayed between brackets [ ]. Press Enter while the blinking cursor is located over the 2 decimal points at the beginning of the directory to return to the list of directories if necessary.

5. Press Jog Arrows to move the blinking cursor over the first letter of the file to be executed.

   Z-axis Jog Arrows will page up or down one screen at a time, while X-axis Jog Arrows will move up or down one line at a time.

6. Press Start to access the particular file. If the operator just presses Enter over the blinking cursor, he or she will only receive a display of the file name, size, and date/time created.

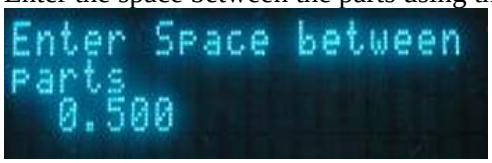


7. Press X-axis Down Jog Arrow twice to access the Step and Repeat function and press Enter .

8. Enter the sheet size in X-axis using the number keypad (e.g., 119.565) and press Enter .

9. Enter the sheet size in Y-axis using the number keypad (e.g., 48.690) and press Enter .

10. Enter the space between the parts using the number keypad (e.g., 0.500) and press Enter .



11. Press X-axis Jog Arrows to select whether the machine should step along the X- or Y-axis.

12. Press X-axis Jog Arrows to select Yes or No for the Serpentine option.

If X-axis is selected above and serpentine is selected next, then the machine will cut the parts in a line down the X-axis, move over in the Y-axis, and cut back up the X-axis. This sequence of motions increases efficiency since the machine will not make a big slew move back to the front of the machine after each row of parts.

13. Press Enter to start the cutting sequence.

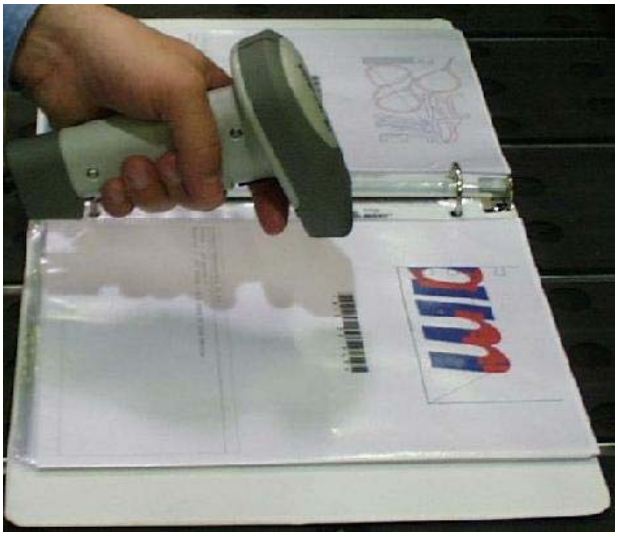
Advanced Keypad

Bar Code Scanner

The ***MultiCam*** Bar Code Scanning Interface has been developed to reduce setup time, minimize errors, and work directly with shop floor work orders.

The bar code scanner works in direct conjunction with JobPreviewer and DNC. The JobPreviewer is used to produce shop floor work orders, which are automatically assigned unique bar code identifications. Once the machine operator scans the bar code, DNC will automatically call up the correct file and send it to the controller. This saves time and reduces the chance for error.

An excellent tool for communication of special instructions, the work order contains a graphical representation of the cut file, material descriptions, and user notes. The bar code label on the work order ensures that the correct job is accessed.



Advanced Keypad

Safety Mat

The Safety Mat is a pressure-sensitive foot mat that will cause the machine to enter into Pause mode when the mat is stepped on during machine operations. This Pause mode can only be cleared by pressing the “Safety Mat Reset” switch at the operator station and then clearing the error at the keypad.

MultiCam advises operators to pause operations during any changing of tools or materials and recommends that operations be paused when any disruptive action (e.g., change of shift, emergency situation) occurs in the cutting area. All cutting operations should be stopped and the machine turned off before any maintenance issues are addressed.

Advanced Keypad

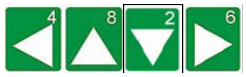
Dual Start

The Dual Start function is available with most CNC systems and requires an Operating (op) station with options for Home 1 and Home 2. Operators who run the same job several times in a row may choose the Dual Start option to maximize the table space and increase productivity.

1. Make sure the Dual Start Module has been loaded on the machine.

2. Set Parameter 24 to 1.

3. Set Soft Homes **1 and 2**. The system will automatically recognize that Dual Start is being requested. Other Home values will not work.

   a. Press Jog Arrows  to position the **center of the cutting head** where the first Soft Home location should be set.

   b. Press Shift and Soft Homes .

   c. Enter 1 for Home 1 and press Enter to record the Soft Home.

   d. Press Jog Arrows to position the **center of the cutting head** where the second Soft Home location should be set.

   e. Press Shift and Soft Homes .

   f. Enter 2 for Home 2 and press Enter to record the second Soft Home.

4. Press DNC .

5. Press X-axis Jog Arrows until the blinking cursor is over the appropriate job file.

6. Press Enter to access the job file.

7. Push button 1 or 2 on the op station to move the cutting head to Soft Home 1 or 2.

8. Press Start to begin the file.

9. Press the other button on the op station to run the same job at the other Soft Home location after the first job file has been completed. Operators should make sure the material has been properly loaded at the other location before beginning the job file at that location.

Advanced Keypad

Menu Items

top

Params_2D	3
X,Y Feedrate	4
Accel Rate	5
Cut Height	6
Lift Height	7
Pierce Delay	8
Pierce Type	9
Pressure Mode	10
Ramp Up Delay	11
Ramp Dn Delay	12
Abrasive	13
Abrasive Delay	14
Abrasive Rate	15
Focus Tube	16
Z Tracking	17
Settings	18
Update Material Library	19
Cut Utilities	20
Material Cutoff	21
Circle	22
Square	23
Rectangle	24
Radiused Rectangle	25
Polygon	27
RipCut	28
Flange	29
Recorded Home	31
Utility	32
Clear Home	33
Show Last Job Time	34
Usage Tracker	35
Set X Park Position	36
DNC Mode	37
Abrasive Low Signal	39
Change Nozzle	40
Line Purge	41
Drill Test	42
Drill Height	43
Reboot	44

SurfMap 45
- Start Z Surf Mapping 46
- SurfMode 47
- X Distance 48
- Y Distance 48
- Step Size 49
- Z Seek Speed 50
- Z Safe Lift 51
- Save Surface Map 52
- Load Surface Map 53
- Surf. Map: Status 54
- Move to Probe Offsets 55
- Test I/O 56

KerfComp 57
Shutdown 58
WJ Pump 59
Pump Control 60
Xb Offset 61

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Params_2D

The Params_2D sub-menu is used to set machine parameters. These sub-menu items allow the machine to be set to certain specifications for cutting different materials, and the settings are ignored with the executed CNC file.

The default settings for the current material are read from the Material Library, and the operator may update the Material Library settings after changing any of the values. Some of these settings may not apply to all waterjets.

1. Press Menu

to access the menu system.

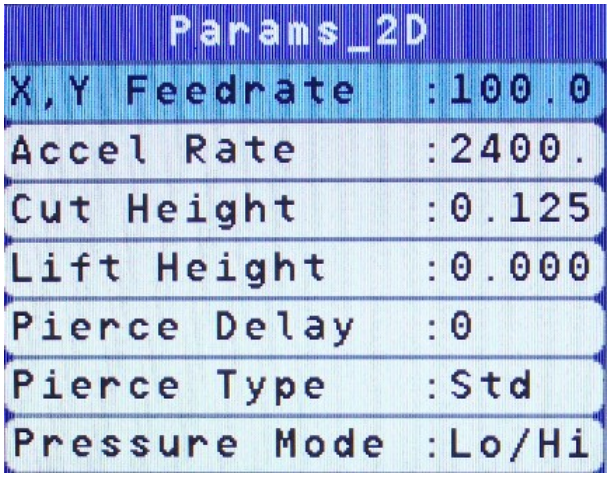
2. Press X-axis Jog Arrows

until Params_2D is highlighted in blue.

3. Press Enter
to access the Params_2D sub-menu.

4. Press X-axis Jog Arrows

until the appropriate option is highlighted in blue. Certain menu items then enter a sub-menu with more selections.



X,Y Feedrate
Accel Rate
Cut Height
Lift Height
Pierce Delay
Pierce Type
Pressure Mode
Ramp Up Delay
Ramp Dn Delay
Abrasive
Abrasive Delay
Abrasive Rate
Focus Tube
Z Tracking
Settings
Update Material Library

Menu

X,Y Feedrate (Cut Speed)

The X & Y Feedrate refers to the rate, measured in inches per minute (IPM), that the head will travel in the X, Y direction through the material while the head is in the PD position (i.e., the Cut Speed). These speed settings will vary with the type of material used.

The Cut Speed function can only be used when **no** feedrate has been programmed in the NC file. The machine will default to 15 IPM if the machine loses power or the controller is rebooted.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

until Params_2D is highlighted in blue.

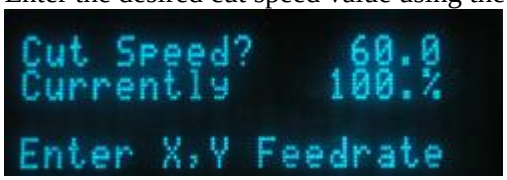
3. Press Enter to access the Params_2D sub-menu.

4. Press X-axis Jog Arrows

until Cut Speed is highlighted in blue.

5. Press Enter to adjust the cut speed.

6. Enter the desired cut speed value using the number keypad (e.g., 60).



7. Press Enter to record the value and return to the Params_2D sub-menu.

Params_2D Menu

Accel Rate

The Acceleration Rate refers to the rate, measured in inches per minute (IPM), that the head will accelerate in the X, Y direction through the material while the head is in the PD position. These speed settings will vary based on the type of material used.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

until Params_2D is highlighted in blue.

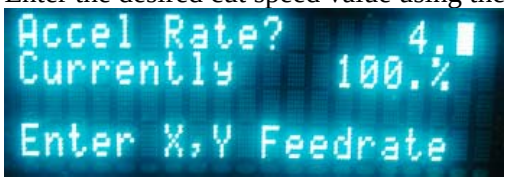
3. Press Enter to access the Params_2D sub-menu.

4. Press X-axis Jog Arrows

until Accel Rate is highlighted in blue.

5. Press Enter to adjust the acceleration rate.

6. Enter the desired cut speed value using the number keypad (e.g., 4.0).



7. Press Enter to record the value and return to the Params_2D sub-menu.

Params_2D Menu

Cut Height

The Cut Height function sets the distance the cutting tip will operate above the surface of the material on a cutting move.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

until Params_2D is highlighted in blue.

3. Press Enter
to access the Params_2D sub-menu.

4. Press X-axis Jog Arrows

until Cut Height is highlighted in blue.

5. Press Enter
to adjust the Cut Height.

6. Enter the Cut Height using the number keypad (e.g., 0.100). A positive value will raise the focal point above the material surface, and a negative value will lower the focal point below the material surface.

7. Press Enter
to accept the value and return to the Params_2D sub-menu.

Params_2D Menu

Lift Height

The Lift Height function sets the distance the waterjet cutting head will rise above the surface of the material between cuts and is only applicable for controller functions, such as Go Home and Matl_Cut, as well as G-Code programs and HPGL programs with no Lift Height included.

The Lift Height allows the head to travel above and across the material and can be modified after the surface is set. The Go Home function will move the Z-axis to the new Lift Height position.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

until Params_2D is highlighted in blue.

3. Press Enter to access the Params_2D sub-menu.

4. Press X-axis Jog Arrows

until Lift Height is highlighted in blue.

5. Press Enter to adjust the Lift Height.

6. Enter the Lift Height using the number keypad (e.g., 0.500).

7. Press Enter to record the Lift Height value. The number entered should be a positive number, but the display will show it as a negative number since movement up from the surface is considered negative while movement down from the surface is considered positive.

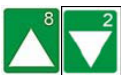
Params_2D Menu

Pierce Delay

The Pierce Delay function configures the length of time in milliseconds between the time the stream is turned on and the waterjet cutting head moves to the Cut Height.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows 

until Params_2D is highlighted in blue.

3. Press Enter to access the Params_2D sub-menu.

4. Press X-axis Jog Arrows

until Pierce Delay is highlighted in blue.

5. Press Enter to adjust the pierce delay.

6. Enter the desired pierce delay value from the number keypad (e.g., 1000).

7. Press Enter to accept the value and return to the Params_2D sub-menu.

Params_2D Menu

Pierce Type

The Pierce Type function specifies the piercing method in a motion based on the focus tube diameter. The standard method pierces the material for the time set in the pierce delay, while the dynamic method pierces the material while moving in a circular motion for the time set in the pierce delay.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

until Params_2D is highlighted in blue.

3. Press Enter to access the Params_2D sub-menu.

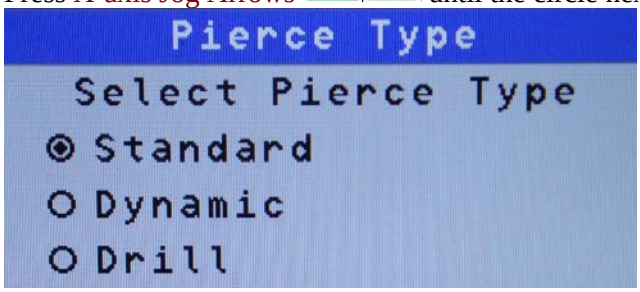
4. Press X-axis Jog Arrows

until Pierce Type is highlighted in blue.

5. Press Enter to select the pierce type.

6. Press X-axis Jog Arrows

until the circle next to the specific pierce type is filled.



7. Press Enter to save the pierce type and return to the Params_2D sub-menu.

Params_2D Menu

Pressure Mode

The Pressure Mode function indicates the pierce and cut pressure modes. Operators can select Low Pierce and Low Cut pressure, Low Pierce and High Cut pressure, or High Pierce and High Cut pressure.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

until Params_2D is highlighted in blue.

3. Press Enter
to access the Params_2D sub-menu.

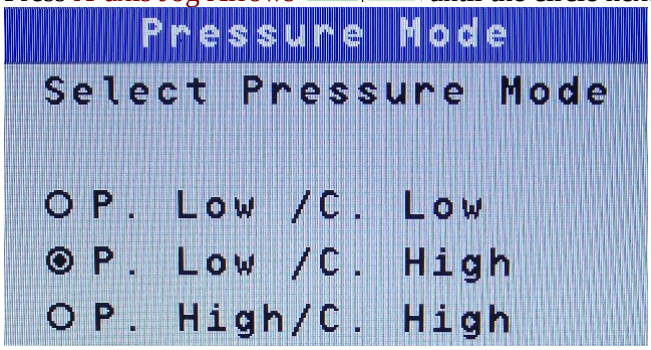
4. Press X-axis Jog Arrows

until Pressure Mode is highlighted in blue.

5. Press Enter
to select the pressure mode.

6. Press X-axis Jog Arrows

until the circle next to the specific pressure mode is filled.



7. Press Enter
to save the pressure mode and return to the Params_2D sub-menu.

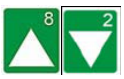
Params_2D Menu

Ramp Up Delay

The Ramp Up Delay allows the intensifier to increase the pressure from low to high. Measured in milliseconds, the Ramp Up Delay is most often used when operators are cutting fragile materials that could shatter at a high pressure pierce.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows 

until Params_2D is highlighted in blue.

3. Press Enter to access the Params_2D sub-menu.

4. Press X-axis Jog Arrows

until Ramp Up Delay is highlighted in blue.

5. Enter the desired delay value using the number keypad (e.g., 5000 msec).

6. Press Enter to record the value and return to the Params_2D sub-menu.

While the **default settings are preferable for most cuts**, operators may manually determine the proper ramp up delay by completing the following:

1. Turn the intensifier ON.

2. Jog the cutting head over an open area on the table.

3. Press WaterJet Test

to access the test function. The Jet Valve should be toggled to OFF, and the Pressure should be toggled to LOW.

4. Press One

to turn on the Jet Valve. This will cause water to spray onto the open area of the table.

5. Watch the pressure gauge on the intensifier.

6. Press Three

to raise the pressure and time how long it takes for the waterjet to reach the high pressure range of the gauge. This value is operator-specific and will vary between machines.

7. Convert that time to milliseconds (e.g., 7 seconds = 7,000 milliseconds) and input that value under Ramp Up Delay.

Params_2D Menu

Ramp Dn Delay

The Ramp Down Delay allows the intensifier to decrease the pressure from high to low. Measured in milliseconds, the Ramp Down Delay is most often used when operators are cutting fragile materials that could shatter at a high pressure pierce.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

until Params_2D is highlighted in blue.

3. Press Enter to access the Params_2D sub-menu.

4. Press X-axis Jog Arrows

until Ramp Dn Delay is highlighted in blue.

5. Enter the desired delay value using the number keypad.

6. Press Enter to record the value and return to the Params_2D sub-menu.

While the **default settings are preferable for most cuts**, operators may manually determine the proper ramp down delay by completing the following:

1. Press WaterJet Test

to access the test function. The Jet Valve should be toggled to OFF, and the Pressure should be toggled to High.

2. Press One

to turn on the Jet Valve. This will cause water to spray onto the open area of the table.

3. Watch the pressure gauge on the intensifier.

4. Press Three

to lower the pressure and time how long it takes for the waterjet to reach the low pressure range of the gauge. This value is operator-specific and will vary between machines.

5. Convert that time to milliseconds (e.g., 7 seconds = 7,000 milliseconds) and input that value under Ramp Dn Delay.

Params_2D Menu

Abrasive

The Abrasive function sets the abrasive during the cutting sequence. Operators may choose to cancel the use of abrasive when cutting softer materials that respond well to high pressure water.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

until Params_2D is highlighted in blue.

3. Press Enter
to access the Params_2D sub-menu.

4. Press X-axis Jog Arrows

until Abrasive is highlighted in blue.

5. Press Enter
to toggle between YES and NO.

Params_2D Menu

Abrasive Delay

The Abrasive Delay function allows the system to hesitate before adding abrasive to the stream and to stop the abrasive near the end of the cut. This prevents build-up of abrasive at the tip of the waterjet cutting head both at the beginning and end of the cutting sequence.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

until Params_2D is highlighted in blue.

3. Press Enter to access the Params_2D sub-menu.

4. Press X-axis Jog Arrows

until Abrasive Delay is highlighted in blue.

5. Press Enter to adjust the abrasive delay.

6. Enter the appropriate delay using the number keypad (e.g., 500).

7. Press Enter to accept the value. The value will be shown on the Params_2D sub-menu.

Params_2D Menu

Abrasive Rate

The Abrasive Rate function sets the rate that the abrasive is fed through the cutting head. The rate ranges between 0 and 2 lb/min (907 g/min).

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

until Params_2D is highlighted in blue.

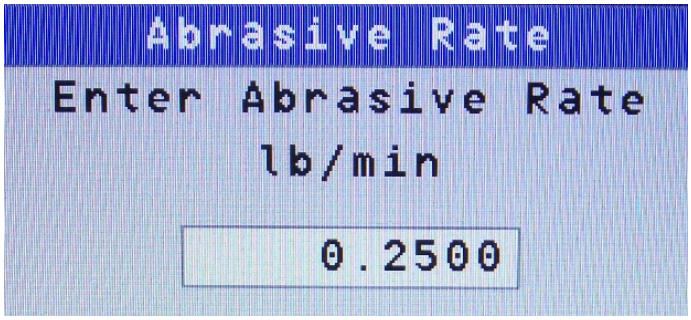
3. Press Enter
to access the Params_2D sub-menu.

4. Press X-axis Jog Arrows

until Abrasive Rate is highlighted in blue.

5. Press Enter
to select the abrasive rate.

6. Enter the amount of abrasive.



7. Press Enter
to save the abrasive rate and return to the Params_2D sub-menu.

Params_2D Menu

Focus Tube

The Focus Tube function shrinks or enlarges the opening through which the water and abrasive travel to cut the material. Larger sizes are needed whenever operators include abrasive in the cutting sequence and whenever the operator wants to cut thicker materials at a faster time.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

until Params_2D is highlighted in blue.

3. Press Enter to access the Params_2D sub-menu.

4. Press X-axis Jog Arrows

until Focus Tube is highlighted in blue.

5. Press Enter to adjust the focus tube diameter.

6. Enter the focus value using the number keypad (e.g., 0.030). The value will display on the Params_2D sub-menu.

Params_2D Menu

Z Tracking

The Z Tracking function configures the waterjet system to complete the cutting sequence while tracking the Z assembly. Operators can operate Z Tracking manually or work it in conjunction with SurfMap.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

until Params_2D is highlighted in blue.

3. Press Enter to access the Params_2D sub-menu.

4. Press X-axis Jog Arrows

until Z Tracking is highlighted in blue.

5. Press Enter to toggle between Manual and Map.

Params_2D Menu

Settings

The Settings function modifies the kerf width and lead in presence and status.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

until Params_2D is highlighted in blue.

3. Press Enter
to access the Params_2D sub-menu.

4. Press X-axis Jog Arrows

until Settings is highlighted in blue.

5. Press Enter
to change the kerf width and lead in status.

a. Kerf Width

i. Press Enter
over Kerf Width.
ii. Enter the corrected value using the number keypad. Negative numbers should be used for an inside cut.
iii. Press Enter
to confirm the value and return to the Settings sub-menu.

b. Lead In

i. Press Enter
over Lead In.
ii. Press Enter
to toggle between YES and NO.

c. Lead In Len

i. Press Enter
over Lead In Len.
ii. Enter the Lead In Length value using the number keypad.
iii. Press Enter
to confirm the value and return to the sub-Settings menu.

Params_2D Menu

Update Material Library

The Update Material Library function updates the saved information that relates to the specifications of the cut and parameters of the cutting sequence.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

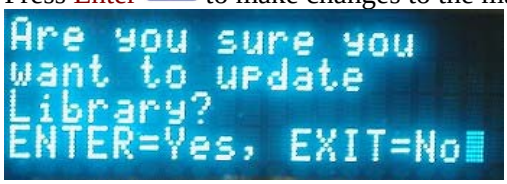
until Params_2D is highlighted in blue.

3. Press Enter to access the Params_2D sub-menu.

4. Press X-axis Jog Arrows

until Update Material Library is highlighted in blue.

5. Press Enter to make changes to the material library.



6. Press Enter to update the material library or Exit to cancel the activity and return to the Params_2D sub-menu.

Params_2D Menu

Cut Utilities

The Cut Utilities sub-menu allows the operator to cut common shapes out of material.

1. Press Menu

to access the menu system.

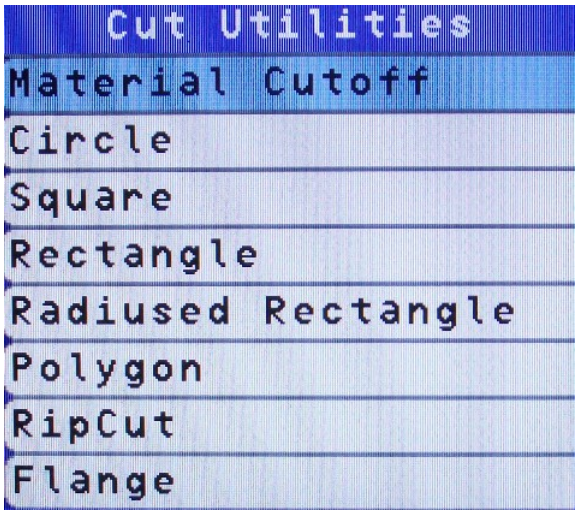
2. Press X-axis Jog Arrows

until Cut Utilities is highlighted in blue.

3. Press Enter
to access the Cut Utilities sub-menu.

4. Press X-axis Jog Arrows

until the appropriate option is highlighted in blue. Certain menu items then enter a sub-menu with more selections.



Material Cutoff
Circle
Square
Rectangle
Radiused Rectangle
Polygon
RipCut
Flange

Menu

Material Cutoff

The Material Cutoff function allows the operator to manually cut off the remainder of the material based on X and Y input. This function does not work from a Soft Home, but Material Cutoff starts at the current Jog location and ends when the operator stops the motion.

1. Set up the system as if a normal file is to be executed (e.g., Material Library, Cut Height, Lift Height, and X & Y Feedrate). It is not necessary to set home as the cut will begin at the current X,Y location of the head assembly.
2. Press Jog Arrows to position the waterjet cutting head in the desired start position.
3. Press Menu to access the menu system.
4. Press X-axis Jog Arrows until Cut Utilities is highlighted in blue.
5. Press Enter to access the Cut Utilities sub-menu.
6. Press X-axis Jog Arrows until Material Cutoff is highlighted in blue.
7. Press Enter to access the Material Cutoff function.
8. Enter the desired value for the X Cutoff Distance using the number keypad (e.g., 0) and press Enter .

9. Enter the desired value for the Y Cutoff Distance using the number keypad (e.g., 60) and press Enter .

10. Press X-axis Down Jog Arrow to access the Dry Run function if needed. This step is optional and can be skipped.
11. Press Start to execute Material Cutoff, Cancel to abort the function, or Pause to reposition the start point.

Cut Utilities Menu

Circle

The Circle function executes any size circle shape. Home is at the center, and the cutting head moves out the length of the radius to complete the cut. Operators should verify that there is enough material to complete the circle before beginning the file.

1. Set up the system as if a normal file is to be executed (e.g., Material Library, Set Home, Cut Height, Lift Height, and X & Y Feedrate).
2. Press Menu

to access the menu system.
3. Press X-axis Jog Arrows

until Cut Utilities is highlighted in blue.
4. Press Enter to access the Cut Utilities sub-menu.
5. Press X-axis Jog Arrows

until Circle is highlighted in blue.
6. Press Enter to access the Circle function.
7. Enter the radius of the Circle using the number keypad (e.g., 0.500) and press Enter .

8. Press X-axis Jog Arrows

to select the direction and press Enter .

9. Press X-axis Forward Jog Arrow

to access the Dry Run function if needed. This step is optional and can be skipped.
10. Press Start to execute Circle Cut, Cancel to abort the function, or Pause to reposition the start point.

Cut Utilities Menu

Square

The Square function executes any size square shape based on operator input. Home is at the front right corner of the shape.

1. Set up the system as if a normal file is to be executed (e.g., Material Library, Set Home, Cut Height, Lift Height, and X & Y Feedrate).
2. Press Menu

to access the menu system.
3. Press X-axis Jog Arrows

until Cut Utilities is highlighted in blue.
4. Press Enter to access the Cut Utilities sub-menu.
5. Press X-axis Jog Arrows

until Square is highlighted in blue.
6. Press Enter to access the Square function.
7. Enter the length of the side for the Square using the number keypad (e.g., 9.000) and press Enter .

8. Press X-axis Down Jog Arrow

to access the Dry Run function if needed. This step is optional and can be skipped.
9. Press Start to execute Square Cut, Cancel to abort the function, or Pause to reposition the start point.

Cut Utilities Menu

Rectangle

The Rectangle function executes any length and width size rectangle shape based on operator input. Home is at the front right corner of the shape.

1. Set up the system as if a normal file is to be executed (e.g., Material Library, Set Home, Cut Height, Lift Height, and X & Y Feedrate).
2. Press Menu

to access the menu system.
3. Press X-axis Jog Arrows

until Cut Utilities is highlighted in blue.
4. Press Enter to access the Cut Utilities sub-menu.
5. Press X-axis Jog Arrows

until Rectangle is highlighted in blue.
6. Press Enter to access the Rectangle function.
7. Enter the length of the X side using the number keypad (e.g., 19) and press Enter .

8. Enter the length of the Y side using the number keypad (e.g., 20) and press Enter .

9. Press X-axis Down Jog Arrow

to access the Dry Run function if needed. This step is optional and can be skipped.
10. Press Start to execute Rectangle Cut, Cancel to abort the function, or Pause to reposition the start point.

Cut Utilities Menu

Radiused Rectangle

The Radiused Rectangle function executes any radius, length, and width size rectangle shape based on operator input. Home is at the front right corner of the shape.

1. Set up the system as if a normal file is to be executed (e.g., Material Library, Set Home, Cut Height, Lift Height, and X & Y Feedrate).
2. Press Menu

to access the menu system.
3. Press X-axis Jog Arrows

until Cut Utilities is highlighted in blue.
4. Press Enter to access the Cut Utilities sub-menu.
5. Press X-axis Jog Arrows

until Radiused Rectangle is highlighted in blue.
6. Press Enter to access the Radiused Rectangle function.
7. Enter the length of the X side using the number keypad (e.g., 19) and press Enter .

8. Enter the length of the Y side using the number keypad (e.g., 20) and press Enter .

9. Enter the radius of the corners using the number keypad (e.g., 1.5) and press Enter .

10. Press X-axis Down Jog Arrow

to access the Dry Run function if needed. This step is optional and can be skipped.

11. Press Start to execute Radiused Rectangle Cut, Cancel to abort the function, or Pause to reposition the start point.

Cut Utilities Menu

Polygon

The Polygon function executes any size polygon shape based on number of sides and radius input by the operator. Home is at the center, and the cutting head moves out the length of the radius to complete the cut. Operators should verify that there is enough material to complete the polygon before beginning the file.

1. Set up the system as if a normal file is to be executed (e.g., Material Library, Set Home, Cut Height, Lift Height, and X & Y Feedrate).
2. Press Menu

to access the menu system.
3. Press X-axis Jog Arrows

until Cut Utilities is highlighted in blue.
4. Press Enter to access the Cut Utilities sub-menu.
5. Press X-axis Jog Arrows

until Polygon is highlighted in blue.
6. Press Enter to access the Polygon function.
7. Enter the number of sides using the number keypad (e.g., 3) and press Enter .

8. Enter the radius using the number keypad (e.g., 0.500) and press Enter .

9. Press X-axis Down Jog Arrow

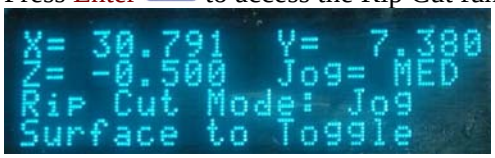
to access the Dry Run function if needed. This step is optional and can be skipped.
10. Press Start to execute Polygon Cut, Cancel to abort the function, or Pause to reposition the start point.

Cut Utilities Menu

Rip Cut

The Rip Cut function allows the operator to manually cut wherever the machine is Jogged in order to remove excess material. This function does not work from Soft Home.

1. Set up the system as if a normal file is to be executed (e.g., Material Library, Cut Height, Lift Height, and X & Y Feedrate). It is not necessary to set home as the cut will begin at the current X,Y location of the waterjet cutting head.
2. Press Jog Arrows to position the waterjet cutting head assembly in the desired start position.
3. Press Menu to access the menu system.
4. Press X-axis Jog Arrows until Cut Utilities is highlighted in blue.
5. Press Enter to access the Cut Utilities sub-menu.
6. Press X-axis Jog Arrows until RipCut is highlighted in blue.
7. Press Enter to access the Rip Cut function.



8. Press Set Surface to toggle between Jog and Cut.

9. Press Jog Arrows to start moving the head assembly, which will plunge into the material after reaching the programmed RPM. The head assembly will cut for as long as the Jog arrow is depressed.
10. Press Set Surface again and as needed to toggle between Jog and Cut.
11. Press Cancel to exit the Rip Cut mode.

Cut Utilities Menu

Flange

The Flange function executes any size flange shape based on operator input. Home is at the front right corner of the shape.

1. Set up the system as if a normal file is to be executed (e.g., Material Library, Set Home, Cut Height, Lift Height, and X & Y Feedrate).
2. Press Menu

to access the menu system.
3. Press X-axis Jog Arrows

until Cut Utilities is highlighted in blue.
4. Press Enter to access the Cut Utilities sub-menu.
5. Press X-axis Jog Arrows

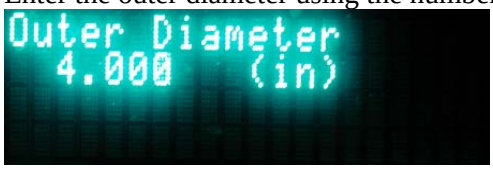
until Flange is highlighted in blue.
6. Press Enter to access the Flange function.
7. Enter the number of bolts for the flange using the number keypad (e.g., 4) and press Enter .

8. Enter the bolt center diameter using the number keypad (e.g., 3.000) and press Enter .

9. Enter the bolt diameter using the number keypad (e.g., 0.500) and press Enter .

10. Enter the inner diameter using the number keypad (e.g., 2.000) and press Enter .

11. Enter the outer diameter using the number keypad (e.g., 4.000) and press Enter .



12. Press X-axis Down Jog Arrow to access the Dry Run function if needed. This step is optional and can be skipped.

13. Press Start to execute Flange Cut, Cancel to abort the function, or Pause to reposition the start point.

Cut Utilities Menu

Recorded Home

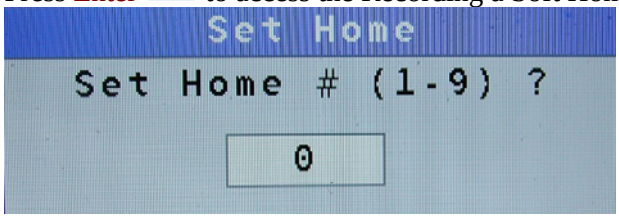
The Recording a Soft Home function sets up to 9 different recordable Home positions that can be used to support multiple cutting fixtures. These Homes stay recorded even after power has been removed from the system.

1. Press Jog Arrows to position the **center of the waterjet cutting head** where the new Soft Home location is to be set.

2. Press Menu to access the menu system.

3. Press X-axis Jog Arrows until Rec_Home is highlighted in blue.

4. Press Enter to access the Recording a Soft Home function.



5. Enter the desired number (1-9) to record the new home.

6. Press Enter to return to the main menu.

Menu

Utility

The Utility sub-menu provides the operator with additional options for completing machine operation. Some of these menu items contain a sub-menu for further specifications. The display extends, so the operator must Jog down to see additional menu items.

1. Press Menu

to access the menu system.

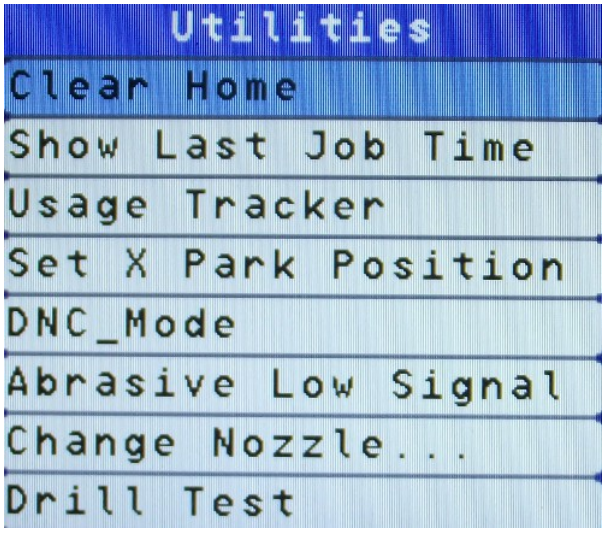
2. Press X-axis Jog Arrows

until Utility is highlighted in blue.

3. Press Enter to access the Utility sub-menu.

4. Press X-axis Jog Arrows

until the appropriate option is highlighted in blue. Certain menu items will then enter a sub-menu with more selections.



Clear Home
Show Last Job Time
Usage Tracker
Set X Park Position
DNC_Mode
Abrasive Low Signal
Change Nozzle
Line Purge
Drill Test
Drill Height
Reboot

Menu

Clear Home

The Clear Home function displays the X & Y coordinates of the Soft Home position from the Hard Home location. This function does not erase Soft Home.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

until Utility is highlighted in blue.

3. Press Enter
to access the Utility sub-menu.

4. Press X-axis Jog Arrows

until Clear Home is highlighted in blue.

5. Press Enter
to clear the home location. The display will return to the Utility sub-menu.

Utility Menu

Show Last Job Time

The Show Last Job Time function displays the amount of time the previous job executed.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

until Utility is highlighted in blue.

3. Press Enter
to access the Utility sub-menu.

4. Press X-axis Jog Arrows

until Show Last Job Time is highlighted in blue.

5. Press Enter
to view the last job time.

6. Press Cancel
to return to the Utility sub-menu.

Utility Menu

Usage Tracker

The Usage Tracker function displays the amount of time each consumable (i.e., Orifice, Nozzle, Bed) has been used. Operators can reset the time after a consumable has been changed.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

until Utility is highlighted in blue.

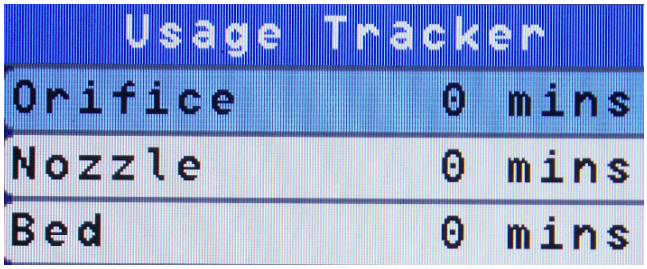
3. Press Enter
to access the Utility sub-menu.

4. Press X-axis Jog Arrows

until Usage Tracker is highlighted in blue.

5. Press Enter
to view the time associated with each consumable.

When a consumable has been replaced, operators should select the consumable and follow the prompts to reset each counter as needed.



6. Press Cancel
to return to the Utility sub-menu.

Utility Menu

Set X Park Position

The Set X Park Position function sets a specific X-axis Park location from Hard Home. This function is useful for operators currently using only a portion of the available table space. The gantry can be set to move just far enough out of the way for the material to be removed instead of parking all the way to the rear every time.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

until Utility is highlighted in blue.

3. Press Enter to access the Utility sub-menu.

4. Press X-axis Jog Arrows

until Set X Park Position is highlighted in blue.

5. Press Enter to access the Set X Park Position function.

6. Enter the desired park position for the head assembly in X using the number keypad (e.g., 100.000) or enter 0 to use the table size.

7. Press Enter to accept the value.

Utility Menu

DNC Mode

The DNC Mode function is used to allow the operator to toggle back and forth between local and remote DNC Modes. Local mode allows the operator to review what files have been saved in the controller, and remote mode allows the operator to run programs. The system must be set to remote mode to run the file.

The DNC Mode can create a shortcut for commonly used files without the operator having to enter the Utility sub-menu each time. The controller memory allows a maximum of 20 job files or a limited amount of memory space for large job files to be saved to the controller. The display will indicate when the memory capacity is full with a notice showing *Error Writing File; Out of Room*. The operator will need to delete a job file from the controller memory before adding any new job files.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

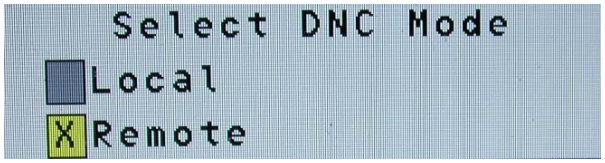
until Utility is highlighted in blue.

3. Press Enter to access the Utility sub-menu.

4. Press X-axis Jog Arrows

until DNC Mode is highlighted in blue.

5. Press Enter to access the DNC mode. An X will be located to the left of the mode currently being run.



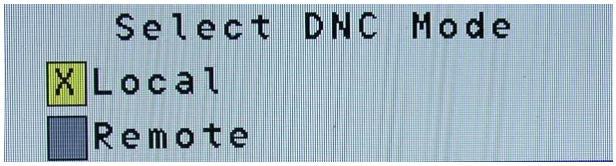
6. Press X-axis Jog Arrows

to move between the DNC Modes. Local mode shows what files have been saved to the controller while the remote mode shows what files are available in the PC.

7. Press Enter to accept the selected mode and return to the Utility sub-menu.

Saving Files to Controller DNC

1. Make sure the DNC mode is set for local.

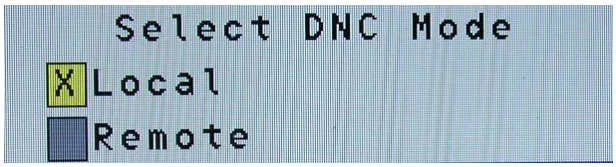


2. Press Shift and DNC to access the list of files available in the PC.

3. Press X-axis Jog Arrows until the particular job file to be saved to the controller is highlighted in blue.
4. Press Enter to accept the job file.
5. Press Start to save the file to the controller. The operator can access the file from the DNC function at the keypad.
6. Press Cancel to return to the Utility sub-menu.
7. Press DNC to access the files available from the controller.
8. Press X-axis Jog Arrows until the particular job file to be run is highlighted in blue.
9. Press Enter to access the job file and then Start to execute the job file.

Deleting Files from Controller DNC

1. Make sure the DNC mode is set for local.



2. Press DNC to access the list of job files available in the controller.
3. Press X-axis Jog Arrows until the particular job file to be deleted from the controller is highlighted in blue.
4. Press Enter to access the job file.
5. Press Material Library to set the system to delete the job file.
6. Press Enter to delete the job file.

Utility Menu

Abrasive Low Signal

The Abrasive Low Signal function sets the number of seconds the operator is allowed to run with low abrasive before the machine pauses. Once the abrasive has been filled, the operator may continue the cutting sequence.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

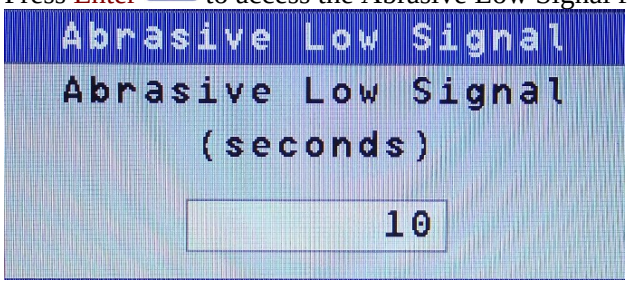
until Utility is highlighted in blue.

3. Press Enter to access the Utility sub-menu.

4. Press X-axis Jog Arrows

until Abrasive Low Signal is highlighted in blue.

5. Press Enter to access the Abrasive Low Signal function.



6. Input the number of seconds and press Enter to return to the Utility sub-menu.

Utility Menu

Change Nozzle

The Change Nozzle function sets the system to allow the operator to change the nozzle between cuts. The waterjet cutting head will move to the Park Z position so that the nozzle can be more easily reached.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

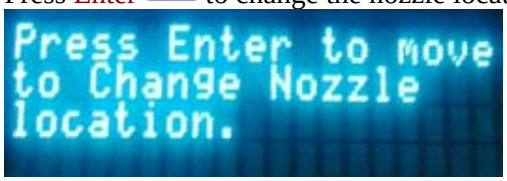
until Utility is highlighted in blue.

3. Press Enter to access the Utility sub-menu.

4. Press X-axis Jog Arrows

until Change Nozzle is highlighted in blue.

5. Press Enter to change the nozzle location.



6. Press Enter to allow the system to move to the Park Z position before changing the nozzle.

7. Press Cancel to return to the Utility sub-menu.

Utility Menu

Line Purge

The Line Purge function removes any particles from the water line. This is important to do before replacing the cutting head or when switching between high pressure and regular operation components.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

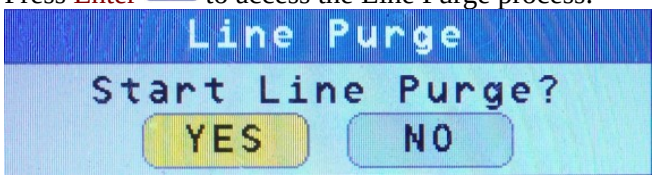
until Utility is highlighted in blue.

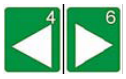
3. Press Enter
to access the Utility sub-menu.

4. Press X-axis Jog Arrows

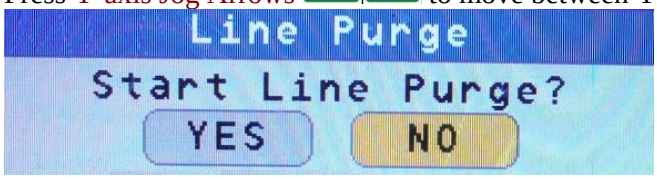
until Line Purge is highlighted in blue.

5. Press Enter
to access the Line Purge process.



6. Press Y-axis Jog Arrows 

to move between Yes and No.



7. Press Enter
to activate the selection for the line purge.

8. Press Cancel
to return to the Utility sub-menu.

Utility Menu

Drill Test

The Drill Test function tests the functionality of the drill and should be completed routinely, especially if the operator notices a change in drill operation.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

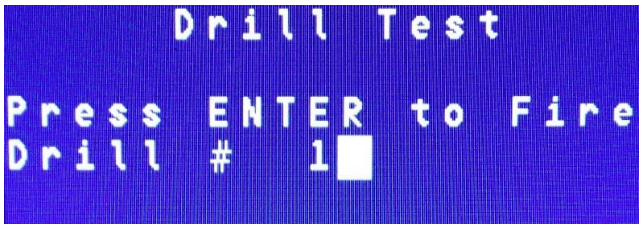
until Utility is highlighted in blue.

3. Press Enter to access the Utility sub-menu.

4. Press X-axis Jog Arrows

until Drill Test is highlighted in blue.

5. Press Enter to test the drill.



6. Press Enter to fire the drill. The display will show when the drill is being fired.

7. Press Cancel to return to the Utility sub-menu

Utility Menu

Drill Height

The Drill Height function sets the height at which the drill will return after the cutting sequence.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

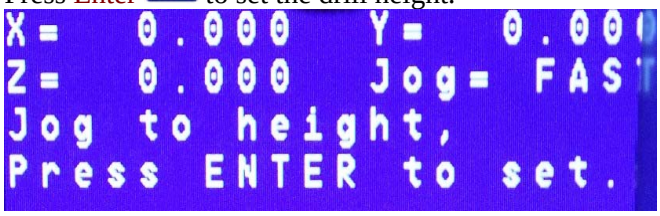
until Utility is highlighted in blue.

3. Press Enter
to access the Utility sub-menu.

4. Press X-axis Jog Arrows

until Drill Hght is highlighted in blue.

5. Press Enter
to set the drill height.



6. Move the cutting head to the proper height and press Enter
to return to the Utility sub-menu.

Utility Menu

Reboot

The Reboot function reboots the controller of the machine without having to power down.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

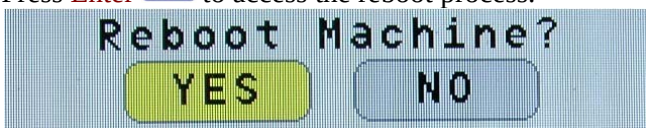
until Utility is highlighted in blue.

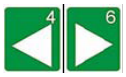
3. Press Enter to access the Utility sub-menu.

4. Press X-axis Jog Arrows

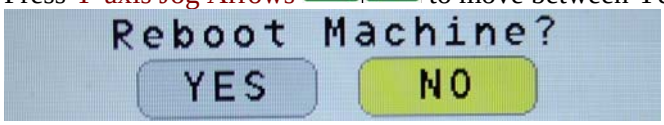
until Reboot is highlighted in blue.

5. Press Enter to access the reboot process.



6. Press Y-axis Jog Arrows 

to move between Yes and No.



7. Press Enter to process the reboot of the machine. If No is selected, then the display will return to the Utility sub-menu.

Utility Menu

SurfMap

The Surface Map sub-menu provides the operator with access to mapping the surface, especially as it relates to uneven surface materials or changes in material thickness. The display extends, so the operator must Jog down to see additional menu items.

1. Press Menu

to access the menu system.

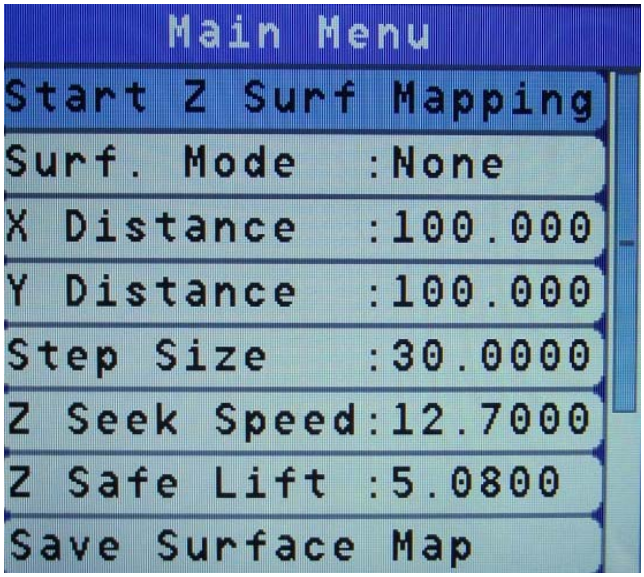
2. Press X-axis Jog Arrows

until SurfMap is highlighted in blue.

3. Press Enter to access the SurfMap sub-menu.

4. Press Jog Arrows

until the appropriate option is highlighted in blue. Certain menu items will then enter a sub-menu with more selections.



Start Z Surface Mapping
Surface Mode
X Distance
Y Distance
Step Size
Z Seek Speed
Z Safe Lift
Save Surface Map
Load Surface Map
Surf. Map: Status
Move to Probe Offsets
Test I/O

Menu

Start Z Surface Mapping

The Start Z Surface Mapping function maps the surface of the material based on the step size, Z seek speed, and other values set in the surface map screen so that the system can familiarize itself with the various depressions and ridges of the material.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

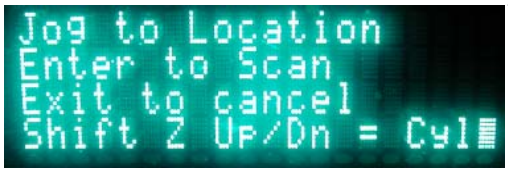
until SurfMap is highlighted in blue.

3. Press Enter
to access the SurfMap sub-menu.

4. Press X-axis Jog Arrows

until Start Z Surf Mapping is highlighted in blue.

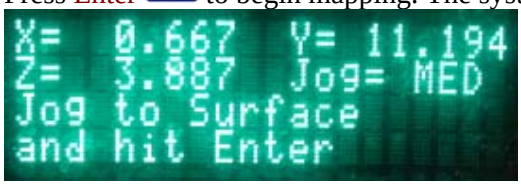
5. Press Enter
to access the Z surface map function.



6. Press Jog Arrows

to place the head assembly at the area to be mapped.

7. Press Enter
to begin mapping. The system will scan the area.



8. Press Z-axis Jog Arrows

to Jog to the surface.

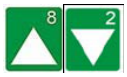
9. Press Enter
to begin mapping the surface. The system will Jog to the surface several times and in several places, prompting the operator to press Enter
between scans. Once the surface has been mapped, the display will return to the SurfMap sub-menu.

SurfMap Menu

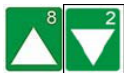
Surface Mode

The Surface Mode function moves between no surface mode, Surface Map, and Radius Check. The operator can access different sub-menu items for each type of surface mode, though these directions will deal with the surface mode None.

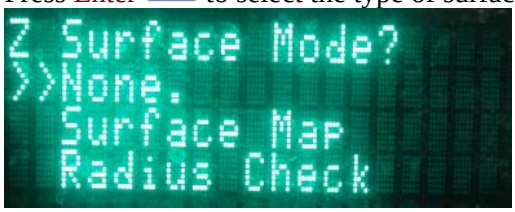
1. Press Menu to access the menu system.

2. Press X-axis Jog Arrows  until SurfMap is highlighted in blue.

3. Press Enter to access the SurfMap sub-menu.

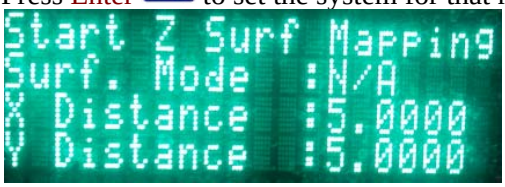
4. Press X-axis Jog Arrows  until Surf. Mode is highlighted in blue.

5. Press Enter to select the type of surface mode (e.g., None).



6. Press Z-axis Jog Arrows to move between the types of modes. The double arrows indicate which mode is selected.

7. Press Enter to set the system for that mode. The SurfMap sub-menu will show the mode selected.



SurfMap Menu

X and Y Distance

The X Distance and Y Distance functions set the limit for both axes.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

until SurfMap is highlighted in blue.

3. Press Enter to access the SurfMap sub-menu.

4. Press X-axis Jog Arrows

until X Distance or Y Distance is highlighted in blue.

5. Press Enter to adjust the distances for either axis.

6. Enter the value for each distance using the number keypad (e.g., 5.000).

7. Press Enter to accept the value entered and return to the SurfMap sub-menu.

SurfMap Menu

Step Size

The Step Size function adjusts the size of the steps taken during scanning.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

until SurfMap is highlighted in blue.

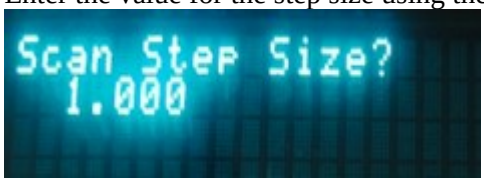
3. Press Enter to access the SurfMap sub-menu.

4. Press X-axis Jog Arrows

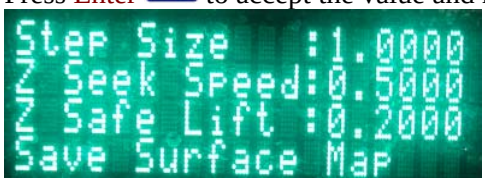
until Step Size is highlighted in blue.

5. Press Enter to adjust the step size.

6. Enter the value for the step size using the number keypad (e.g., 1.000)



7. Press Enter to accept the value and return to the SurfMap sub-menu.



SurfMap Menu

Z Seek Speed

The Z Seek Speed function modifies the seeking speed for the Z assembly.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

until SurfMap is highlighted in blue.

3. Press Enter to access the SurfMap sub-menu.

4. Press X-axis Jog Arrows

until Z Seek Speed is highlighted in blue.

5. Press Enter to access the Z assembly speed.

6. Enter the value for the Z assembly speed using the number keypad (e.g., 0.500).

7. Press Enter to accept the value entered and return to the SurfMap sub-menu.

SurfMap Menu

Z Safe Lift

The Z Safe Lift function sets the distance of the lift between each probe. The default value is 0.2” (5.08mm).

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

until SurfMap is highlighted in blue.

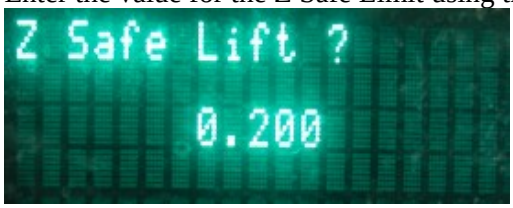
3. Press Enter to access the SurfMap sub-menu.

4. Press X-axis Jog Arrows

until Z Safe Lift is highlighted in blue.

5. Press Enter to access the Z Safe Limit.

6. Enter the value for the Z Safe Limit using the number keypad (e.g., 0.200).



7. Press Enter to accept the value entered and return to the SurfMap sub-menu.

SurfMap Menu

Save Surface Map

The Save Surface Map function saves up to 4 surface maps. The system maintains this information in the Material Library.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

until SurfMap is highlighted in blue.

3. Press Enter to access the SurfMap sub-menu.

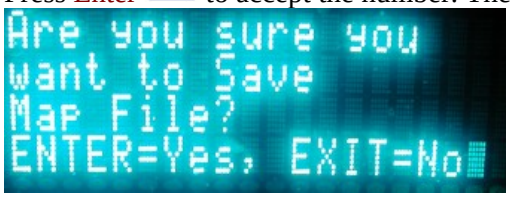
4. Press X-axis Jog Arrows

until Save Surface Map is highlighted in blue.

5. Press Enter to enter the surface map to be saved.

6. Enter the value for the map being saved using the number keypad.

7. Press Enter to accept the number. The system will prompt the operator about saving the Map File.



8. Press Enter to update or Cancel to exit without saving.

SurfMap Menu

Load Surface Map

The Load Surface Map function loads a saved surface map into the system. If no surface map has been saved, then no surface map can be loaded.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

until SurfMap is highlighted in blue.

3. Press Enter to access the SurfMap sub-menu.

4. Press X-axis Jog Arrows

until Load Surface Map is highlighted in blue.

5. Press Enter to access the saved surface map.

6. Enter the value for the saved surface map using the number keys. If the operator types in a map number that does not exist, the system will indicate that the map number does not exist and will return to the SurfMap sub-menu.

7. Press Enter to access the saved surface map.

SurfMap Menu

Surf. Map: Status

The Surface Map: Status function validates the surface map. With the surface map enabled, the displayed Z value on the keypad will change according to the map. Operators can activate the map and Jog in the X- and Y-axes to verify the Z position. If no surface map has been loaded, then the status will remain inactive.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

until SurfMap is highlighted in blue.

3. Press Enter to enter the SurfMap sub-menu.

4. Press X-axis Jog Arrows

until Surf. Map: Status is highlighted in blue.

5. Press Enter to toggle the surface map to active or inactive.

SurfMap Menu

Move to Probe Offsets

The Move to Probe Offsets function verifies that the X and Y probe offsets are set correctly. These values are also set in parameters 215 and 216.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

until SurfMap is highlighted in blue.

3. Press Enter to enter the SurfMap sub-menu.

4. Press X-axis Jog Arrows

until Move to Probe Offsets is highlighted in blue.

5. Press Enter to access the probe offsets.

6. Press Enter to move the offsets.

7. Press Cancel to return to the main menu.

SurfMap Menu

Test I/O

The Test I/O function tests the inputs and outputs of the Surface Map system.

1. Press Menu

to access the menu system.

2. Press X-axis Jog Arrows

until SurfMap is highlighted in blue.

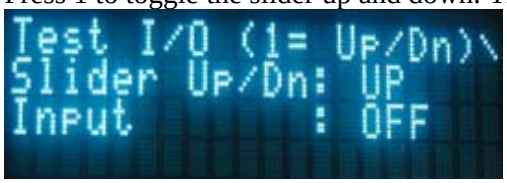
3. Press Enter to enter the SurfMap sub-menu.

4. Press X-axis Jog Arrows

until Test I/O is highlighted in blue.

5. Press Enter to test the input/output.

6. Press 1 to toggle the slider up and down. The display will indicate which direction is active.



7. Press Cancel to exit the Test I/O function and return to the SurfMap sub-menu.

SurfMap Menu

Kerf Compensation

The Kerf Compensation function adjusts the kerf compensation value, which is the distance the waterjet must be moved either to the inside for internal cuts or holes or the outside for external cuts to produce the desired cut size. ***MultiCam*** uses left kerf almost exclusively so that CCW in the codes indicates internal cuts and CW indicates external cuts.

1. Press Menu

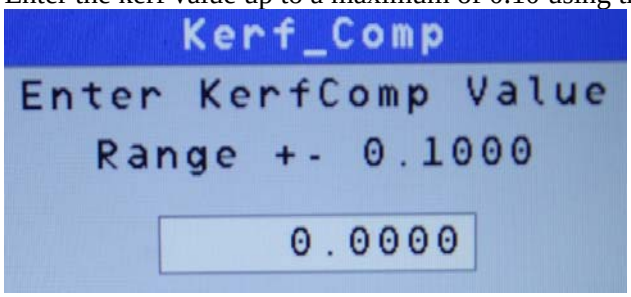
to access the menu system.

2. Press X-axis Jog Arrows

until Kerf_Comp is highlighted in blue.

3. Press Enter
to adjust the kerf compensation.

4. Enter the kerf value up to a maximum of 0.10 using the number keypad.



5. Press Enter
to accept the value. The display will return to the main menu. Menu

Shutdown

The Shutdown function takes the servos offline to allow the machine to be powered down safely and is used as the fourth step in the Shutdown sequence to safely end the operating functions of the waterjet. Operators should follow the power down sequence shown on the Fast Start when shutting down the machine at the end of the day or if there will be no cutting sequences performed for an extended period of time.

1. Press Menu

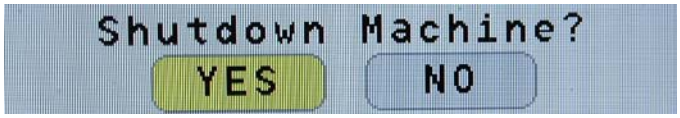
to access the menu system.

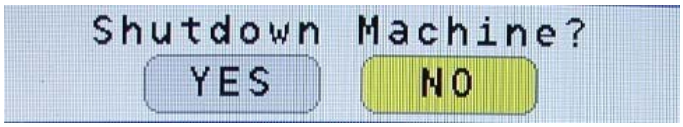
2. Press X-axis Jog Arrows

until Shutdown is highlighted in blue.

3. Press Enter to access the Shutdown sequence. Operators may press Y-axis Jog Arrows

to move between Yes and No.





4. Press Enter when Yes is highlighted to shut down the machine. The system will disable the motor drives and prompt the operator when it is safe to power down the machine. If No is selected, then the display will return to the main menu.

Menu

WJ Pump

The WaterJet Pump sub-menu provides troubleshooting information for operations and errors that may have occurred during regular operations.

1. Press Menu

to access the menu system.

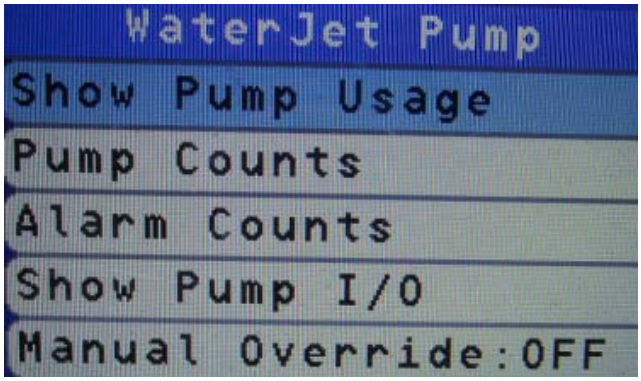
2. Press X-axis Jog Arrows

until WJ Pump is highlighted in blue.

3. Press Enter to access the WJ Pump sub-menu.

4. Press X-axis Jog Arrows

until the appropriate option is highlighted in blue. Certain menu items will then enter a sub-menu with more selections.



- Show Pump Usage – Time counters of usage
- Pump Counts – Time counters of strokes on either side (if balanced, the numbers should be even)
- Alarm Counts – Instance counters of errors
- Show Pump I/O – Status of each input or output
- Manual Override – Setting of system to allow for manually releasing water pressure

Menu

Pump Control

The Pump Control function allows the operator to activate the pump in the cutting sequence. This menu item is only available on the V Series.

1. Press Menu

to access the menu system.

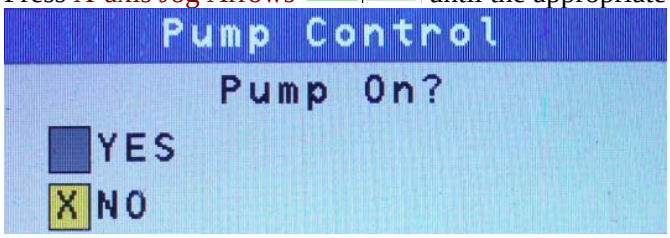
2. Press X-axis Jog Arrows

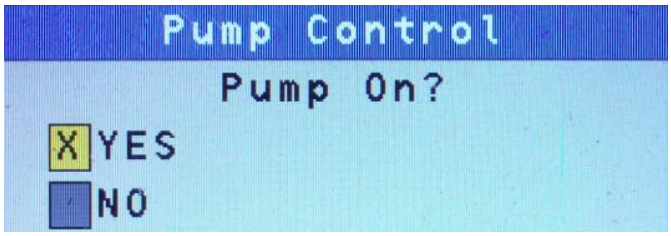
until Pump Control is highlighted in blue.

3. Press Enter to access the Pump Control function.

4. Press X-axis Jog Arrows

until the appropriate setting is selected.





5. Press Enter to save the selection.

6. Press Cancel to return to the main menu.

Menu

Xb Offset

The Xb Offset function allows operators to set the distance between the main cutting head and the secondary cutting head on dual head systems. The Xb Offset menu item is not available on single head cutting systems.

1. Press Menu

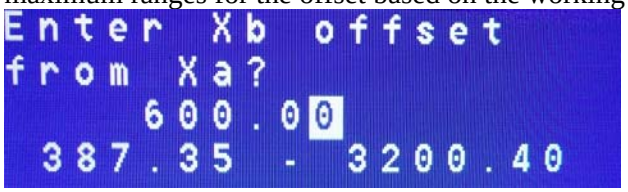
to access the menu system.

2. Press X-axis Jog Arrows

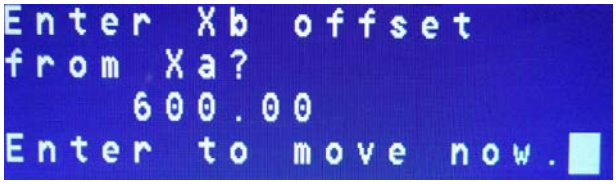
until Xb Offset is highlighted in blue.

3. Press Enter to access the Xb Offset function.

4. Enter the XB offset value from XA (e.g., 600mm). The keypad will automatically show the minimum and maximum ranges for the offset based on the working area.



5. Press Enter to move XB to the offset.



6. Set up the dual head configuration from the keypad.

Menu

Options

top

Laser Pointer	2
Intensifier	3
Chiller	4
Abrasive Removal System	5
Closed Loop Filtration System	6
Abrasive Feeder and Hopper	7
Operator Station	8
Water Table	9

Laser Pointer

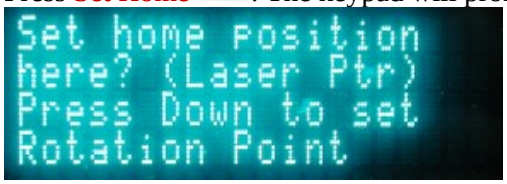
The Laser Pointer option allows operators to set Home using the laser diode rather than relying solely on naked eye approximations. With the laser diode mounted on the carriage of the machine and pointed at the material surface, operators can see exactly where the cutting sequence will begin and set their Home locations exactly. Once the offset is established, operators can begin using the laser pointer to set Home. The offset will not need to be reset unless the laser diode is replaced or loses its orientation to the cutting head.

1. Turn on the Laser Pointer by pressing 0 . Operators can toggle the Laser Pointer ON and OFF* by pressing 0, and the Home screen will show whether or not the Laser Pointer is active by inserting the letter L in the lower right corner. (Operators who wish to set Home with the standard method should leave the Laser Pointer OFF.)

   * **Operators cannot set Home using the Laser Pointer if the Laser Pointer is OFF**.

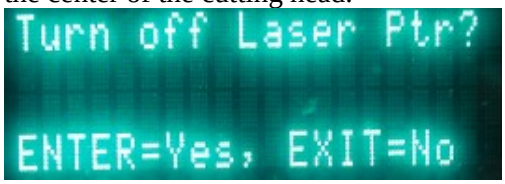
2. Jog the Laser Pointer to the Home location.

3. Press Set Home . The keypad will prompt the operator to set the Home location using the Laser Pointer.



4. Press Enter to set Home.

5. Press Enter to leave the Laser Pointer ON or Cancel to turn the Laser Pointer OFF. If the Laser Pointer is left on, the laser beam will **not** follow the cutting head as it cuts since the Laser Pointer is offset from the center of the cutting head.



6. Finish system preparations and run the file.

Options

Intensifier

The Intensifier is an integral part of the waterjet as it supplies the power to operate the cutting head and the intensity of the water flow. Operators may choose which level of horsepower (e.g., 15, 30, 50, 75, and 100) would be most appropriate for their cutting needs based on the size of the machine and the material being cut. When operators require a faster cut with cleaner edges, they often prefer higher pressure systems. A single intensifier can produce up to 60,000 psi.

Options

Chiller

The Chiller cools the hydraulic oil used to operate the intensifier. Not all systems need this option as tap water can also be used for operations that do not generate a lot of heat. For optimal performance, the Chiller should be selected with a power level that is compatible with the power of the Intensifier.

2000 Series

3000 Series

Options

Abrasive Removal System

The Abrasive Removal System removes the cutting aggregate or abrasive from the catch tank and transfers it to another receptacle. This process allows for easier disposal of the used abrasive.

Options

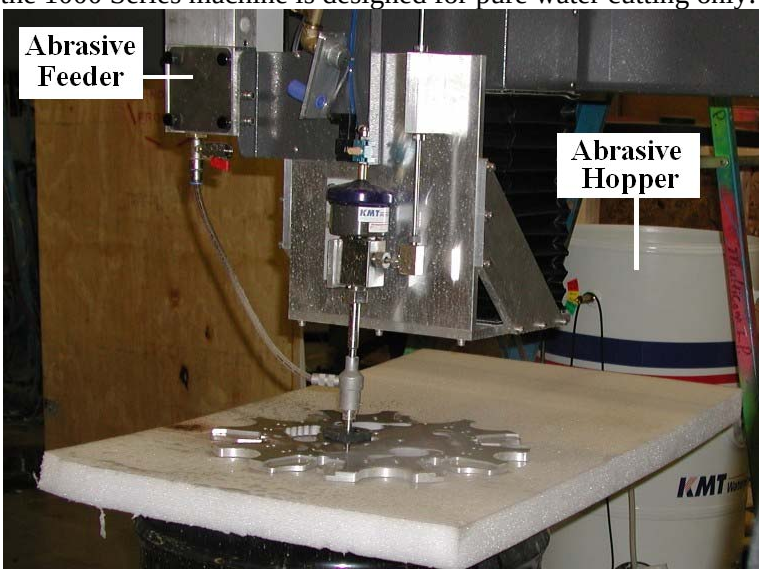
Closed Loop Filtration System

The Closed Loop Filtration System or water filtration system cleans the cutting and cooling water that cannot be discarded through a sewer or other normal water waste treatment system. The Closed Loop Filtration System is more efficient with water usage and reduces component and machine maintenance.

Options

Abrasive Feeder and Hopper

The Abrasive Feeder and Hopper work in conjunction to add abrasive to the water stream for all abrasive cutting systems. The Feeder is attached at the cutting head and holds a specific amount of abrasive for immediate access during the cutting sequence, while the Hopper holds the remaining abrasive apart from the machine and channels it as needed to the Feeder. The abrasive used in all ***MultiCam*** machines is garnet, and the water stream joins with the abrasive at the cutting head. Operators may choose to add the Abrasive Feeder and Hopper to any 4000 or 6000 Series machine; the 1000 Series machine is designed for pure water cutting only.



Options

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Operator Station

The Operator Station option comes equipped with a flat panel PC, keyboard, mouse, standard operation buttons and knobs, and the electrical components typically located in the electrical cabinet. For 4000 and 6000 Series machines, the operator station is a standalone feature. For 3000 Series machines, the operator station is attached to the table. Each Operator Station is customized for the machine.

4000 and 6000 Series

3000 Series

Options

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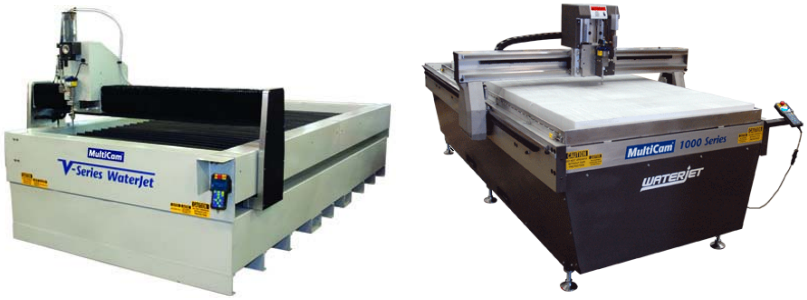
Water Table

The Water Table option provides operators with a cutting surface that can adequately handle large amounts of water and abrasive used in the cutting sequence. Operators may request a specific size table based on the size of the machine and the material being cut. The 1000 Series machine uses pure water only and is configured with a table already intact while the 3000 and 4000 Series machines have an intact table but use both pure water and abrasive cutting. Water Tables are only available on 6000 Series machines, though some operators choose to provide their own cutting tables.

V and 1000 Series with table intact



3000 Series with table intact

4000 Series with table intact

6000 Series with optional water table

Options

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Connections

top

Communication 2
Ethernet
- Ethernet Connection Information 2
- Setup for Ethernet Connection 8
- Ethernet Cables 11

Serial
- Setup for Serial Connection 12
- Communication Troubleshooting 15
- Communications Port Settings of Windows 17
- Serial Line Amplifier 19
- Serial Cable Construction 20
- Serial Communication 21

Communication

The ***MultiCam*** Controller will support both Ethernet and Serial communications; however, ***MultiCam*** recommends using Ethernet communications whenever possible. Connect

Ethernet Connection Information

TCP/IP Ethernet connection is the preferred form of communications to all ***MultiCam*** controllers. The following information discusses several key components of Ethernet connections and how those components relate to connecting personal computers (PCs) and ***MultiCam*** CNC machines.

Requirements

Any company choosing to utilize ***MultiCam*** Ethernet communications as recommended must meet the following system requirements:

- Network card installed in the computer
- TCP/IP software installed in the computer
- Ethernet 10/100 MHz multiple port switch (cannot be wireless or a router)
- Ethernet patch cabling
- ***MultiCam*** Controller IP/Subnet in the same class network (IP/Subnet) as the Host PC

Wireless communication is not recommended for any ***MultiCam*** Ethernet system.

Ethernet Process

Every computer on a network has an IP address. The IP address tells other computers that the Host PC is ready to communicate with another device on the network. Each computer IP address must be unique within that network (e.g., 192.168.0.176 is the IP address for only one computer on the network).

In addition to IP addresses, each computer on a network is also assigned a subnet address. The subnet address is simply a way of separating larger networks into smaller, more manageable ones (e.g., 255.255.255.0 is one subnet address for ***MultiCam*** operating systems). Additionally, ***MultiCam*** CNC machines by design can only be used on a class “C” Network.

Setup

When any technician visits a customer site, he or she must first determine what type of network is available for the connection. The 2 types of networks are described below.

- Dynamic Host Configuration Protocol (DHCP) Network – Automatic Configuration

  The DHCP server will automatically provide networked computers with the required TCP/IP configuration from a central location. When a computer requires the use of TCP/IP network resources, it broadcasts a request for address information. The DHCP server responds to this request by assigning a new address and sending it to the computer along with other required configuration information for the network. This information is acknowledged by the computer and used in setting up that configuration.

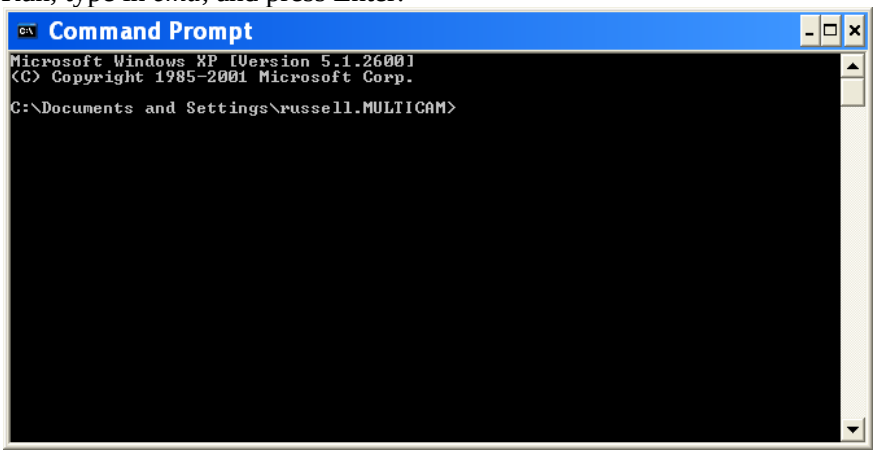
- Static Network – Manual Configuration

  The static network has a manually configured setup for each computer or device, and each device must be assigned the same subnet mask but a different IP address from all other computers and devices.

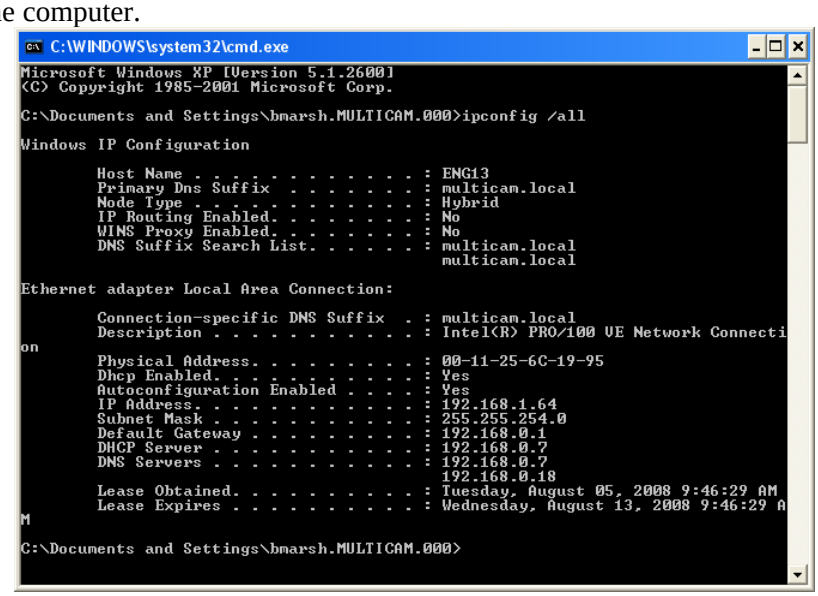
By default, most laptops and computers are shipped with DHCP already enabled. This does NOT mean that the network has a DHCP server that will automatically assign the computer an individual IP address. Technicians should still complete the following to determine the proper configuration for the machine:

1. Use the command prompt in Windows to check the IP configuration. Technicians can use either of the following methods:
   a. Go to Start >> All Programs >> Accessories >> Command Prompt.

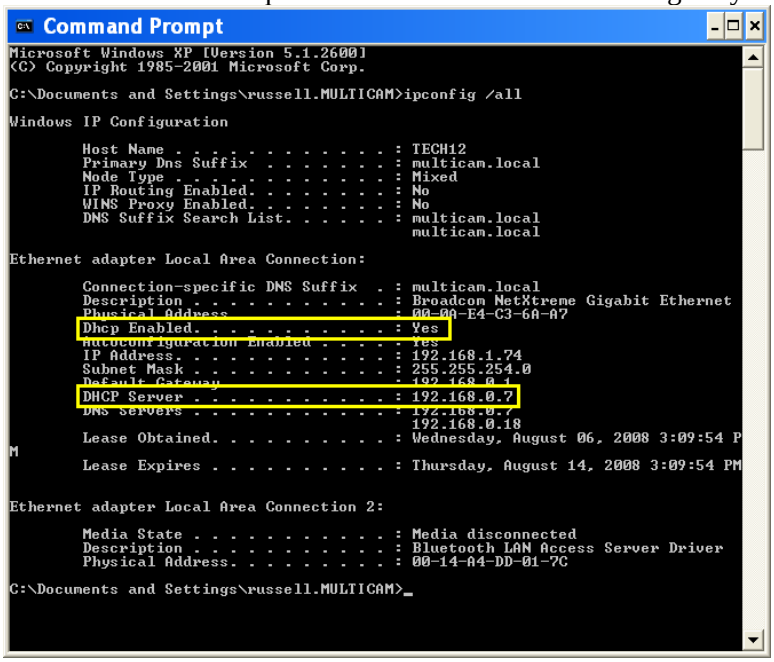
   b. Go to Start >> Run, type in *cmd*, and press Enter.



2. Type in *ipconfig /all* with a space between the *g* and the forward slash. This will pull up the Windows IP configuration for the computer.


C:\WINDOWS\system32\cmd.exe
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.
C:\Documents and Settings\bmarsh.MULTICAM.000>ipconfig /all
Windows IP Configuration
Host Name . . . . . : ENG13
Primary Dns Suffix . . . . . : multicam.local
Node Type . . . . . : Hybrid
IP Routing Enabled. . . . . : No
WINS Proxy Enabled. . . . . : No
DNS Suffix Search List. . . . . : multicam.local
multicam.local
Ethernet adapter Local Area Connection:
Connection-specific DNS Suffix . : multicam.local
Description . . . . . : Intel(R) PRO/100 VE Network Connecti
on
Physical Address. . . . . : 00-11-25-6C-19-95
Dhcp Enabled. . . . . : Yes
Autoconfiguration Enabled . . . . : Yes
IP Address. . . . . : 192.168.1.64
Subnet Mask . . . . . : 255.255.254.0
Default Gateway . . . . . : 192.168.0.1
DHCP Server . . . . . : 192.168.0.7
DNS Servers . . . . . : 192.168.0.7
192.168.0.18
Lease Obtained. . . . . : Tuesday, August 05, 2008 9:46:29 AM
Lease Expires . . . . . : Wednesday, August 13, 2008 9:46:29 A
M
C:\Documents and Settings\bmarsh.MULTICAM.000>

3. Look for the IP address and subnet mask in the *ipconfig /all* screen (i.e., DHCP Enabled status and the DHCP Server address). This information will be required if the technician has to change any of the addresses.


Command Prompt
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.
C:\Documents and Settings\russell.MULTICAM>ipconfig /all
Windows IP Configuration
Host Name . . . . . : TECH12
Primary Dns Suffix . . . . . : multicam.local
Node Type . . . . . : Mixed
IP Routing Enabled. . . . . : No
WINS Proxy Enabled. . . . . : No
DNS Suffix Search List. . . . . : multicam.local
multicam.local
Ethernet adapter Local Area Connection:
Connection-specific DNS Suffix . : multicam.local
Description . . . . . : Broadcom NetXtreme Gigabit Ethernet
Physical Address. . . . . : 00-0A-E4-C3-6A-A7
Dhcp Enabled. . . . . : Yes
IP Address. . . . . : 192.168.1.74
Subnet Mask . . . . . : 255.255.254.0
DHCP Server . . . . . : 192.168.0.7
192.168.0.18
Lease Obtained. . . . . : Wednesday, August 06, 2008 3:09:54 P
M
Lease Expires . . . . . : Thursday, August 14, 2008 3:09:54 PM
Ethernet adapter Local Area Connection 2:
Media State . . . . . : Media disconnected
Description . . . . . : Bluetooth LAN Access Server Driver
Physical Address. . . . . : 00-14-A4-DD-01-7C
C:\Documents and Settings\russell.MULTICAM>

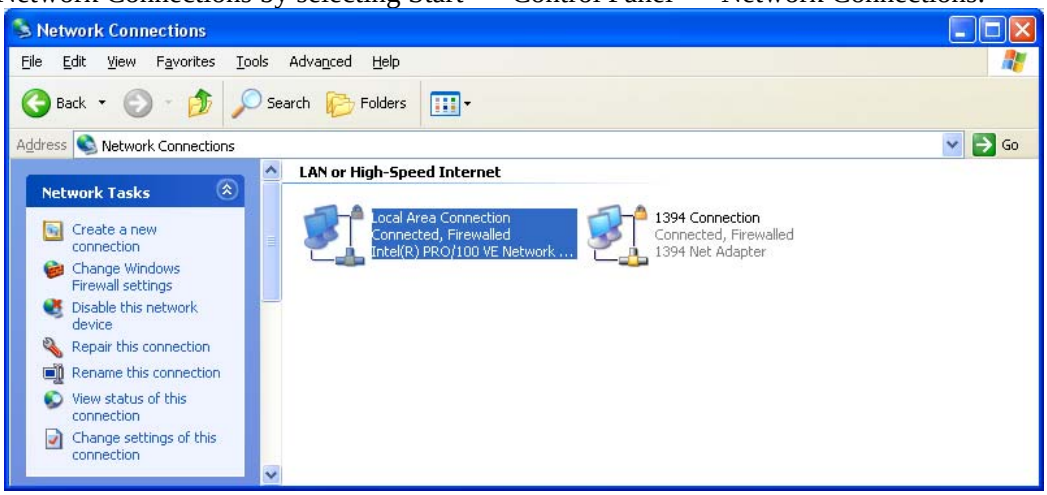
- If the network has an active DHCP, then DHCP Enabled will show *Yes*. The technician must also have an assigned IP address for the DHCP server (shown above).
- If the network does not have an active DHCP, then DHCP Enabled will show *No*, which indicates a static network.
- If any of the above information is not provided, then the technician is working with a static network.

Static Network Changes

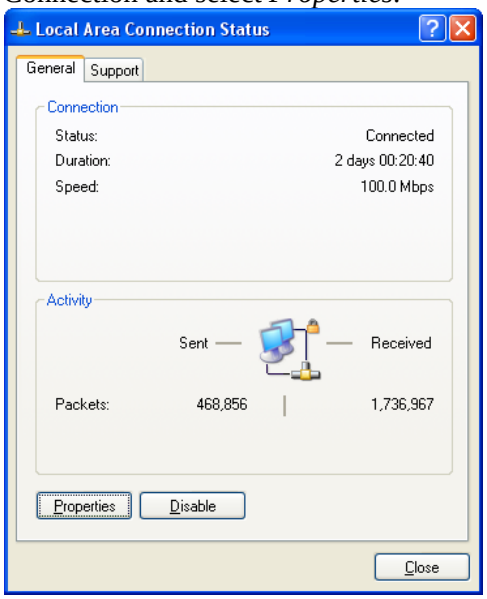
Technicians working with a static network may have to change the static IP and/or subnet address of the computer, the controller, or both. The following directions describe how technicians can change the IP and subnet addresses:

Computer Static IP/Subnet Address

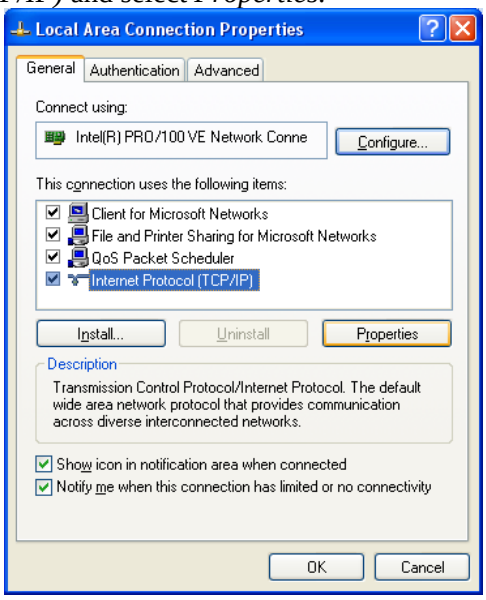
1. Access Network Connections by selecting Start >> Control Panel >> Network Connections.



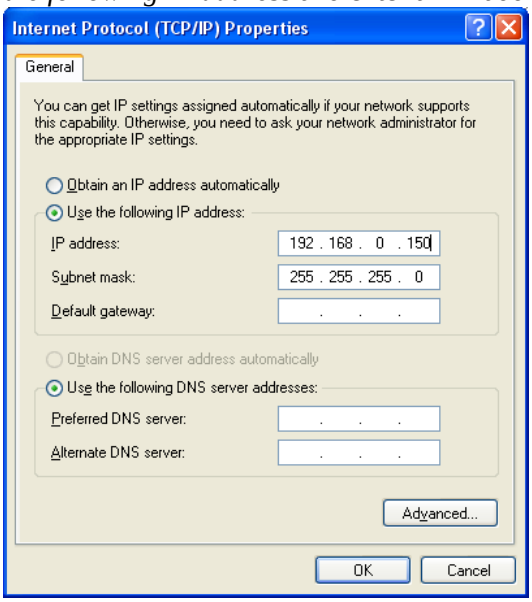
2. Double-click on the Local Area Connection and select *Properties*.



3. Highlight *Internet Protocol (TCP/IP)* and select *Properties*.



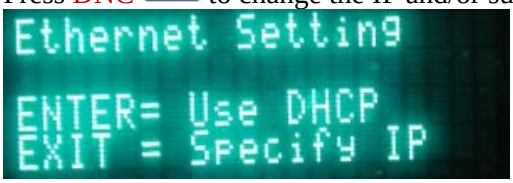
4. Click in the circle next to *Use the following IP address* and enter an IP address and the subnet mask.


Internet Protocol (TCP/IP) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
192 . 168 . 0 . 150
Subnet mask:
255 . 255 . 255 . 0
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

Controller Static IP/Subnet Address

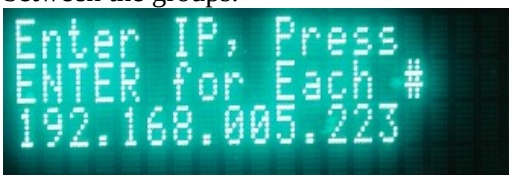
1. Press Shift, Help, and Two to access the Ethernet Information screen on the keypad.

2. Press DNC to change the IP and/or subnet mask address.



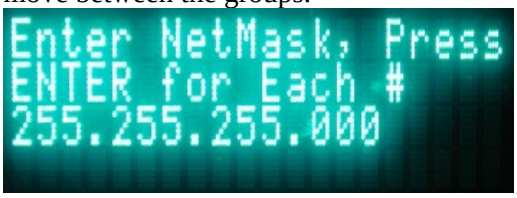
3. Press Exit to specify the IP address.

4. Type in the IP address as 4 groups of 3 numbers (e.g., 192.168.005.223) and press Enter to move between the groups.



5. Press Enter and wait for the screen to prompt for the netmask.

6. Type in the netmask address as 4 groups of 3 numbers (e.g., 255.255.255.000) and press Enter to move between the groups.



7. Press Enter to save the changes.

8. Reboot the machine for the IP and/or subnet mask address changes to take effect.

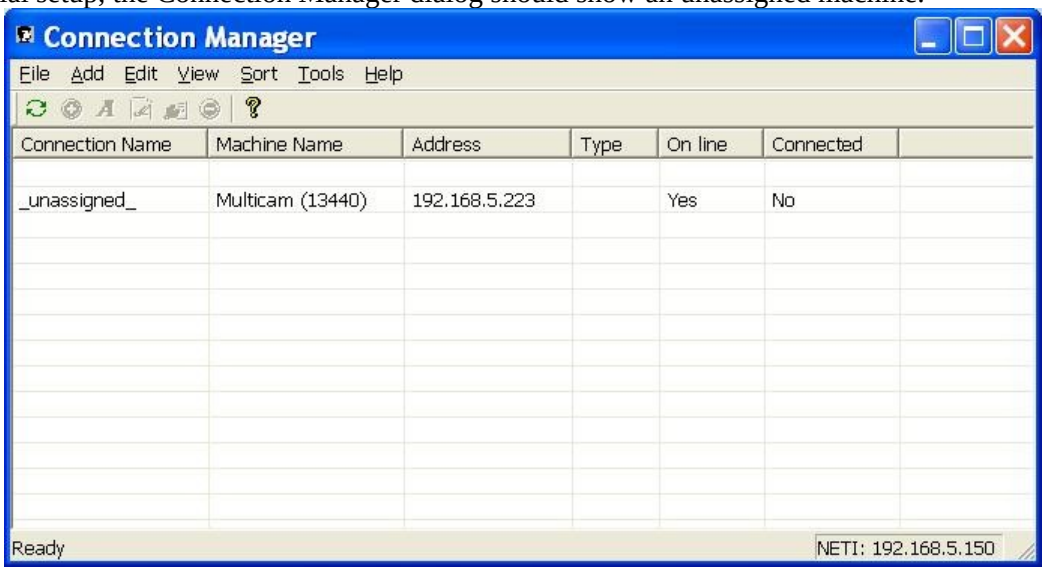
Connect

Setup for Ethernet Connection

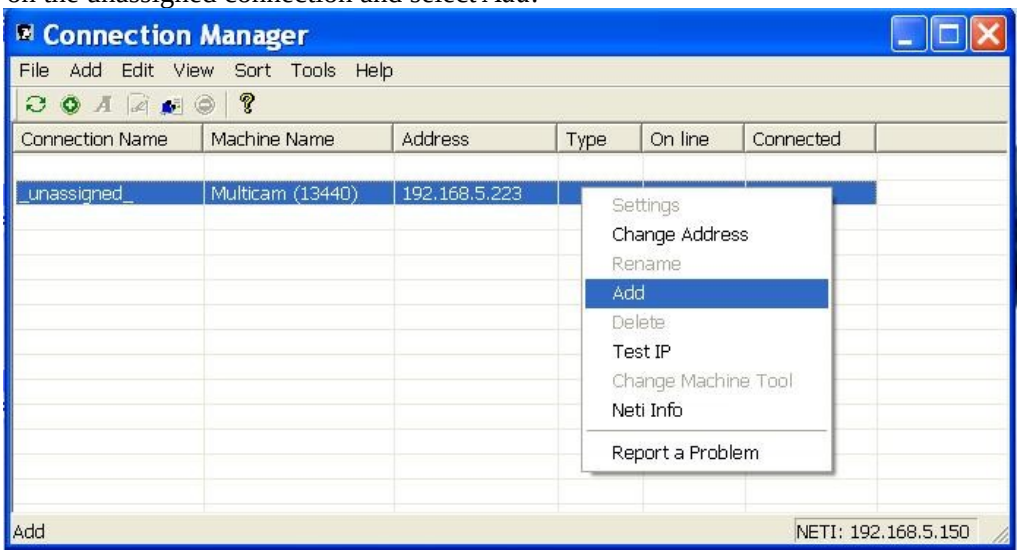
The Ethernet communication is set up through the Machine Tool Properties applet. Operators should make sure that the CNC machine is on and connected to the computer via an Ethernet connection before attempting to automatically install the Ethernet connection. The following directions assume that the operator has complied with all hardware requirements for Ethernet connections (see **Ethernet Connection Information**).

1. Right-click on the Machine Connections icon in the toolbar and select Connection Manager.

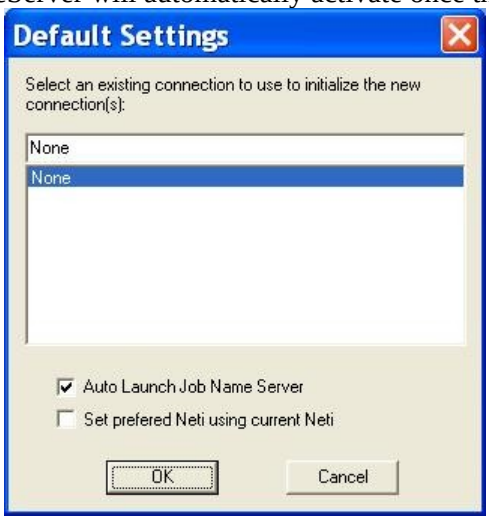
At the initial setup, the Connection Manager dialog should show an unassigned machine.



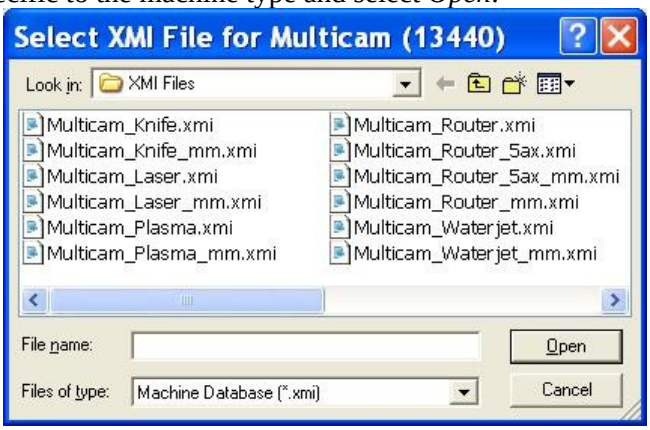
2. Right-click on the unassigned connection and select *Add*.



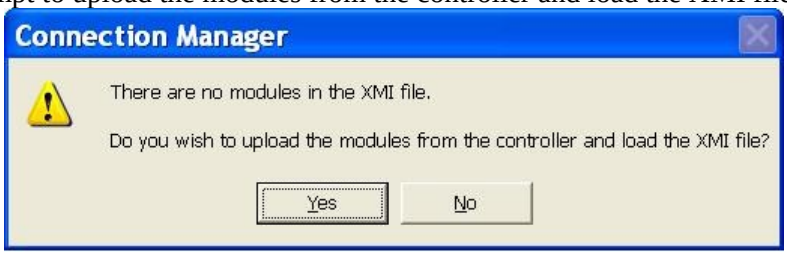
3. Select *None* at the Default Settings dialog. All customers are encouraged to check the box next to *Auto Launch Job Name Server* so that JobNameServer will automatically activate once the machine is connected.



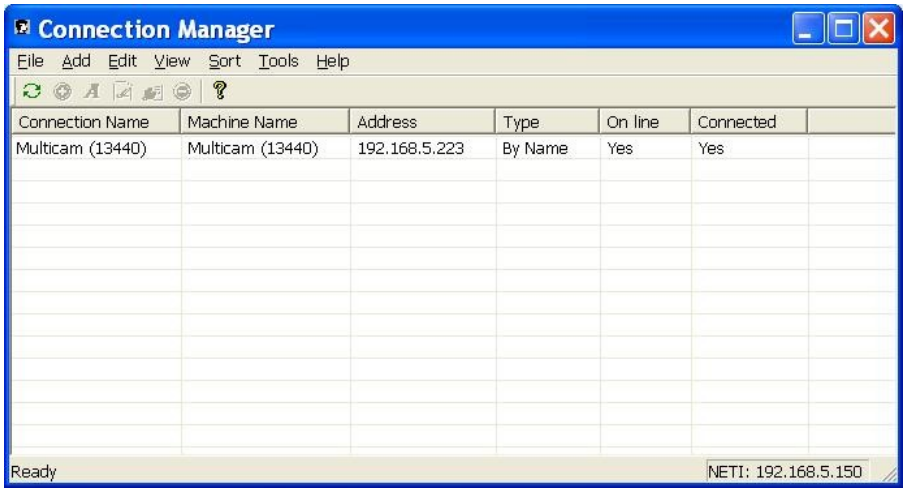
4. Highlight the XMI files specific to the machine type and select *Open*.



5. Select *Yes* at the prompt to upload the modules from the controller and load the XMI file.


Connection Manager
There are no modules in the XMI file.
Do you wish to upload the modules from the controller and load the XMI file?
Yes
No

This will assign a connection name to the machine.



Connect

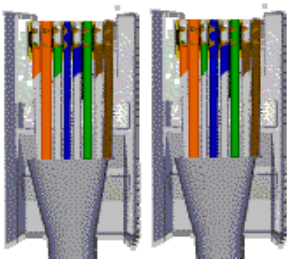
Ethernet Cables

If the company has an established network, then the computers are probably already connected through a hub or switch. A patch cable is a standard cable used to connect a network device consisting of a computer, a network printer, and a ***MultiCam*** Controller to a hub or switch. However, the patch cable is unable to provide a direct connection with the ***MultiCam*** Controller, so the host PC must be connected through a switch or hub.

RJ45 Patch Cable

A patch cable is also known as a straight-through cable. The wires are in the same order on connector 1 as they are on connector 2. The RJ45 connectors are used on each end of the cable, and operators must verify that the connectors are being held the same way when checking. Connect

Connector 1		Connector 2
Pin 1	>>>	Pin 1
Pin 2	>>>	Pin 2
Pin 3	>>>	Pin 3
etc...	>>>	etc...

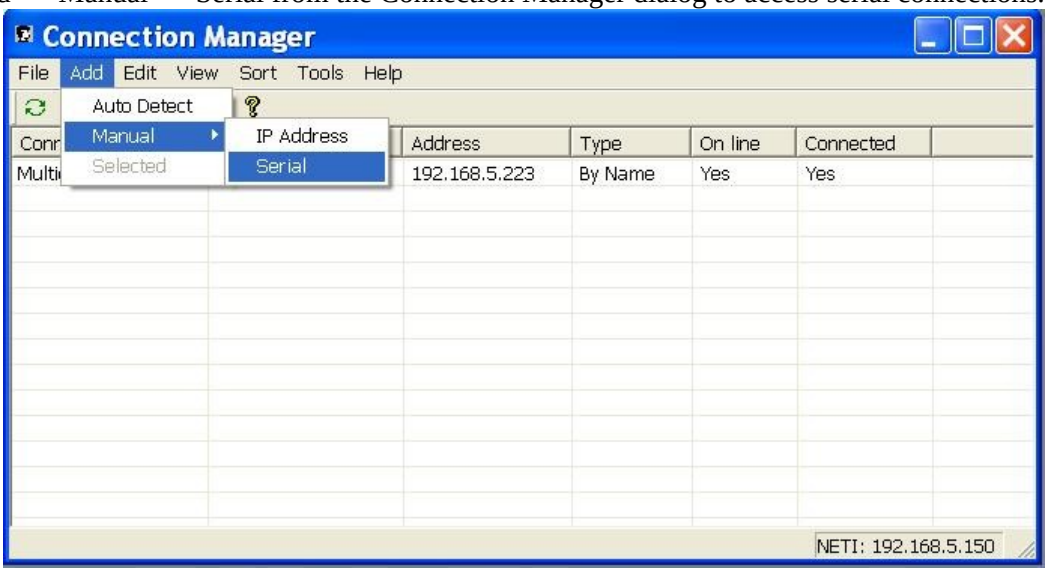


Setup for Serial Connection

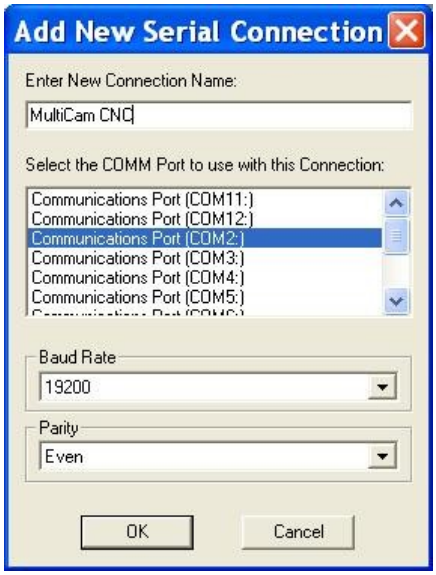
The serial communication is set up through Machine Tools. Ethernet communication is always recommended over serial, but operators may need to use serial connections for troubleshooting or quick-fixes for communication.

1. Right-click on the Machine Connections icon in the toolbar and select Connection Manager.

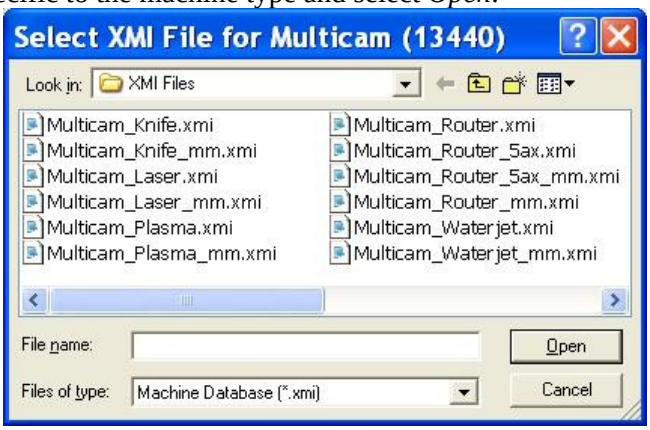
2. Select Add >> Manual >> Serial from the Connection Manager dialog to access serial connections.



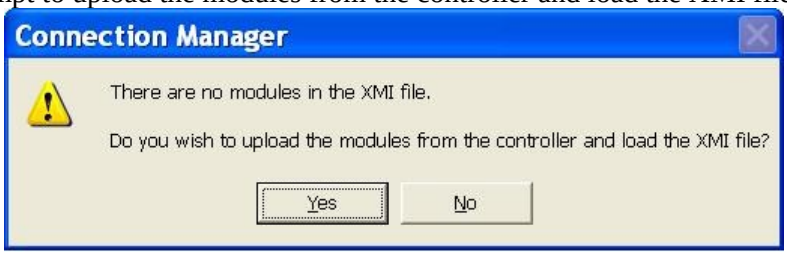
3. Enter or select the following information and select *OK*:
   - Connection Name (e.g., MultiCam CNC)
   - Communications port (e.g., COM2)
   - Baud Rate – 19200
   - Parity – Even



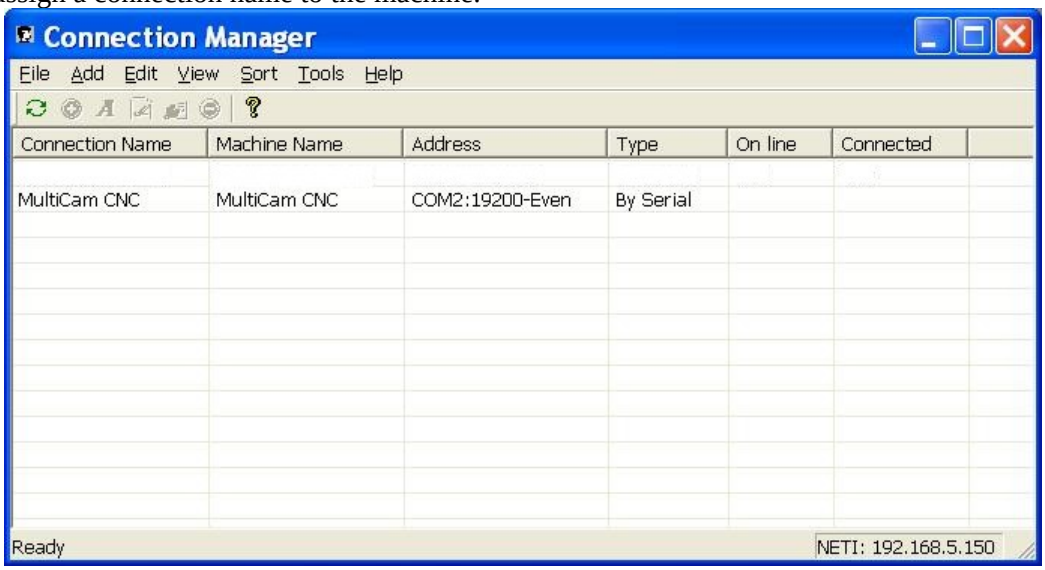
4. Highlight the XMI files specific to the machine type and select *Open*.



5. Select *Yes* at the prompt to upload the modules from the controller and load the XMI file.


Connection Manager
There are no modules in the XMI file.
Do you wish to upload the modules from the controller and load the XMI file?
Yes
No

This will assign a connection name to the machine.



Connect

Communication Troubleshooting

The ***MultiCam*** CNC machine is shipped with no connectors, and operators should purchase a 25' serial cable containing 9 wires to connect the ***MultiCam*** Controller to the Host PC. Data is sent from the computer to the machine controller. The data leaves the computer, passes through the computer Com Port or serial port, and moves through the serial cable and into the controller. Occasionally, operators experience difficulty when the machine does not accept a file, is unable to access DNC, loses connection, never establishes connection, or cuts off in a straight line in a manner that is not part of the original output file.

Most Common Reasons for Communication Failure

If the machine works some of the time but experiences random problems, then the machine may be experiencing some sort of communication problem. Here is a list of the most common problems for communication failure. Operators are encouraged to refer to this file before calling the local support technician or the ***MultiCam*** Technical Support.

* The Windows Com Port settings, especially the FIFO buffer, are not correct. See **Communications Port Settings of Windows**.

* The serial cable is longer than 100ft and is used without a Line Amplifier. See **Serial Line Amplifier**.

* The serial cable has been operated next to high voltage or fluorescent lights.

* The cable has been nicked, cut, or damaged in some fashion. See **Serial Cable Construction**.

* The wrong Com Port has been selected on the host PC.

* The Com Port IRQ conflicts with a modem installed in the host PC.

* The internal ribbon cable inside the machine control cabinet has been damaged or has lost its connection.

* The Max202 chip on the control board has failed.

Troubleshooting

The process of elimination is often used when troubleshooting various communication problems as more than one problem may have caused the current machine difficulty and different types of machines will respond differently to similar communication problems. The serial ports in the machine and in the computer could be damaged by a bad electrical storm or a comparable natural occurrence, and this damage will not always be fixed the same way for each machine. Below are common sites for communication problems and suggested ways to repair the damage.

Port Settings should be checked to verify that port settings and communication settings are correct.

* Machines that were manufactured after January 1996 have the following communication settings:
  Baud rate: 19200; parity: even; data bits: 8; stop bits: 1

* Machines that were manufactured before January 1996 have the following communication settings:
  Baud rate: 9600; parity: none; data bits: 8; stop bits: 1

Cable Testing 1 can be started with unplugging the serial cable from the side of the machine and plugging it back in before unplugging the serial cable from the back of the computer and plugging it back in. If the communications are still not working, Cable Testing 2 may help.

Cable Testing 2 involves opening the control box to inspect the cable connection extending from the side of the box where the external serial cable is plugged into the control board. This cable will be a ribbon cable plugged into the control board labeled G960, M10, M23 or M24. The connection going into the board can be unplugged and plugged back in. On many systems, there is an additional small ribbon cable extending from the top control board to the bottom control board that can also be tested. If the communications are still not working, Computer Port Testing 1 may help.

Computer Port Testing 1 for a computer with 2 serial ports involves plugging the machine into the other serial port and changing the port setting in DNC or the machine file output software. **Computer Port Testing 1** for a system with a serial port mouse involves plugging the mouse into the old port associated with the CNC machine. Windows should find the mouse automatically. If the machine works and the mouse does not, then the computer Com Port is probably bad and will need to be repaired by the computer vendor. If the communications are still not working, Computer Port Testing 2 may help.

Computer Port Testing 2 involves unplugging the serial cable from the side of the machine control box and plugging the loop-back plug provided in the tool box into the open end of the serial cable. After going to a DOS prompt, the operator should change directories to the mc directory (cd\mc) and run COMCHK.EXE. This will test the serial port and the cable. If the communication status is bad, errors will display on the screen. These errors could point to a faulty cable or a computer serial port. The test can be ended by pressing the ESC key. If the communication status is good, a continuous line of dots will appear along the bottom of the screen. If this happens, Machine Port Testing may help.

Machine Port Testing involves unplugging the serial cable from the computer and plugging the loop-back plug provided in the tool box into the open end of the serial cable. The collet and cover nut from the spindle should be removed, and the machine should be turned off and back on. If the machine enters self-test and begins to move, then the machine communications and serial cable are okay. At this point, the operator can probably assume there must be a problem with the computer Com Port or associated settings. If this process does not work, then 1 of 3 things have happened:

1. The serial port chip is bad and needs to be replaced. ***MultiCam*** can be contacted for the chip and installation instructions.

2. The internal ribbon cable connections have been damaged.

3. There is no self-test file loaded in the controller. ***MultiCam*** can be contacted for additional Help.

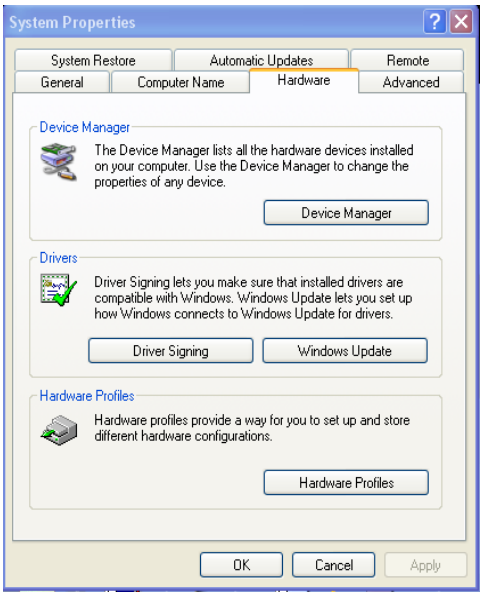
Connect

Communications Port Settings of Windows

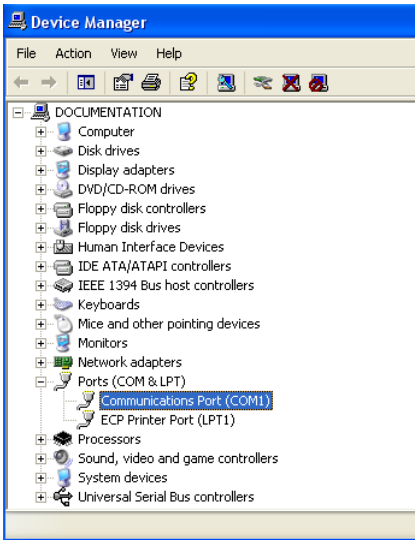
Most PCs are running Windows 2000 or higher as the Operating System. The default configuration of Windows is set to take advantage of larger (16 byte) FIFOs in the COM ports.

The ***MultiCam*** Controller has 4 to 7 character-receive FIFOs, which is less than half the standard default setting. Operators should reduce their Transmit FIFO levels when using a ***MultiCam*** Controller to lessen the chance for poor communications or loss of data that would result from having the settings too high.

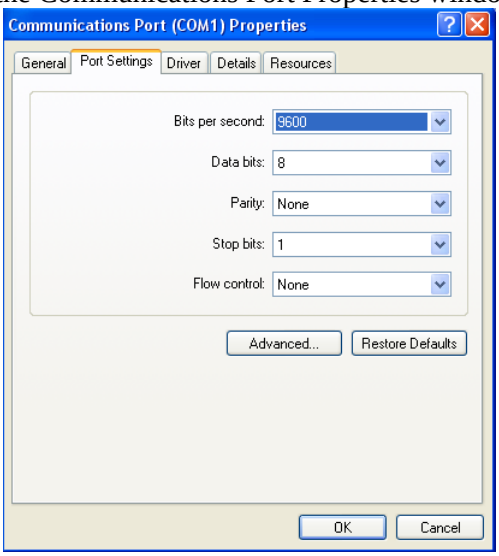
1. Right-click on the My Computer icon from the Windows Desktop and select the Hardware tab. Select *Device Manager*.


System Properties
System Restore
Automatic Updates
Remote
General
Computer Name
Hardware
Advanced
Device Manager
The Device Manager lists all the hardware devices installed on your computer. Use the Device Manager to change the properties of any device.
Device Manager
Drivers
Driver Signing lets you make sure that installed drivers are compatible with Windows. Windows Update lets you set up how Windows connects to Windows Update for drivers.
Driver Signing
Windows Update
Hardware Profiles
Hardware profiles provide a way for you to set up and store different hardware configurations.
Hardware Profiles
OK
Cancel
Apply

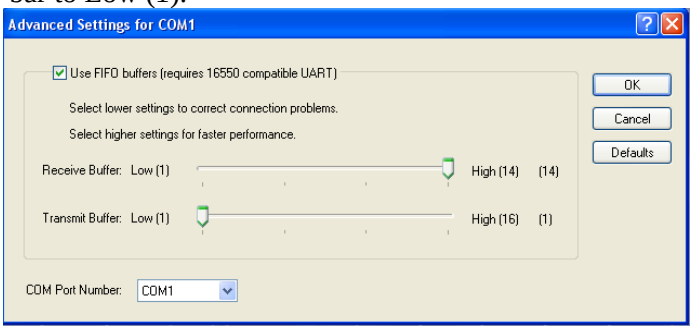
2. Select Ports (COM & LPT) and then select Communications Port (COM1) or the port to which the ***MultiCam*** Controller serial cable is connected.



3. Select the Port Settings tab from the Communications Port Properties window and select *Advanced*.



4. Drag the Transmit Buffer bar to Low (1).


Advanced Settings for COM1
Use FIFO buffers (requires 16550 compatible UART)
Select lower settings to correct connection problems.
Select higher settings for faster performance.
Receive Buffer: Low (1) High (14) (14)
Transmit Buffer: Low (1) High (16) (1)
COM Port Number: COM1
OK
Cancel
Defaults

5. Select *OK* to all the windows that were opened and restart Windows to activate this setting. Connect

Serial Line Amplifier

MultiCam recommends using the Bravo Line Amplifier or a comparable serial line amplifier and requires a line amplifier when the serial cable reaches or exceeds 100'. Not using the line amplifier will create communication problems between the host PC and the ***MultiCam*** CNC machine as too much load will be placed on the Com Port as well as on the Max202 chip of the ***MultiCam*** Controller.

The installation of the serial line amplifier involves the AC power adapter, line amplifier, DB25 female to DB9 male adapter, a 6' adapter cable with a DB25 male connector and DB25 female connector, and a serial cable with a DB9 male connector and DB9 female connector.

1. Flip the line amplifier over and make sure that the 2 switches are positioned towards the middle of the line amplifier.

2. Place the DB25 male connector of the 6' adapter cable into the "To DTE" end of the line amplifier.

3. Place the DB25 female connector on the other end of the 6' adapter cable into an available Com Port of the PC.

4. Place the DB25 female end of the DB25 female to DB9 male adapter into the "To DCE" end of the line amplifier.

5. Place the DB9 female end of the serial cable into the DB9 male end of the DB25 female to DB9 male adapter.

6. Insert the AC power adapter plug into the socket on the line amplifier and plug it into an AC outlet.

Connect

Serial Cable Construction

Operators should avoid installing serial cables next to high voltage lines and should prevent any foot traffic from occurring over or across the serial cables. The serial cable should not be involved in a situation where damage is probable, and operators who create their own serial cables should not exceed 100'. Serial cables that exceed 100' require the assistance of line amplifiers, and ***MultiCam*** has tested lengths of serial cable up to 1000' that utilized serial line amplification.

The following is the pin out for the ***MultiCam*** serial cable. In both cases, Pin #9 is not used.

Computer End, DB9 Female

Pin #	*Color*
1	(not used)
2	Red
3	Blue
4	White
5	Yellow
6	Black
7	Orange
8	Brown

Machine End, DB9 Female

Pin #	*Color*
1	(not used)
2	Blue
3	Red
4	Black
5	Yellow
6	White
7	Brown
8	Orange

Connect

Serial Communication

The ***MultiCam*** Controller can communicate with a host PC through an RS232 Serial or Com Port. The serial port transmits one bit at a time spread out serially over time. Since only 1 bit rather than 8 is transmitted at a time, only 1 data line exists in the cable for each direction of travel with 2 lines total. A half-duplex allows only 1 data line enabling communication in 1 direction at a time, while the full-duplex allows 2 data lines enabling simultaneous communications in both directions. Thus, a serial port cable is thinner than a parallel port cable.

The port is called an RS232 port because the electrical characteristics follow the EIA Recommended Standard #232, which specifies the operating voltage (± 12V), relative to a common reference. Other details, such as impedance and driver capacity, are specified in this standard.

The controller's default configuration for options within the standard is 8 data bits, 1 stop bit, no parity, full-duplex, and hardware handshaking. Baud rates supported are 9.6K, 19.2K, 38.4K, and 57.6K bits per second with the standard setting being 19.2K.

The controller operates better when the device transmitting the motion commands obeys DTR hardware handshaking. The sophisticated processing and motion firmware provides continuous motion under most circumstances. In the event that additional processing time is required by the controller and the incoming character buffer fills, the DTR handshaking line will go low to prevent further transmissions of commands from the host PC. When the controller has processed enough of the incoming character buffer, it will then raise DTR and the host PC will resume transmitting. Connect

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Software

top

Software 2
- AlphaCam Post Processor Installation 2
- EnRoute Driver Setup 4
- EnRoute View and Preference Settings 7

MultiCam Software 12
Motion Controller Utilities 12
- JobNameServer 13
- JobEditor 14
- JobReporter 14
- MotionMechanic 15
- ConnectionManager 15
- JobConsole 16
- Material Library Editor 17

JobNameServer Programs
- Digitize 23
  - Digitize Commands 23
  - Manual Digitize 25
  - Rapid Shape 26
  - Rapid Shape Tips and Troubleshooting 27
  - Using Rapid Shape 28
- HotWatch 30
- JobQueue 30
- HPGL Command Support 31
- HPGL Commands 33

MultiCam M- and G-Code Support 34
Mapping M Code to Output 37
Glossary 39

Software

The ***MultiCam*** WaterJet can use files created from many popular software packages in the industry, such as AlphaCam and EnRoute, as well as files created in G Code and HPGL. The productivity suite enhances communication between the ***MultiCam*** WaterJet and the host PC. Software

AlphaCam Post Processor Installation

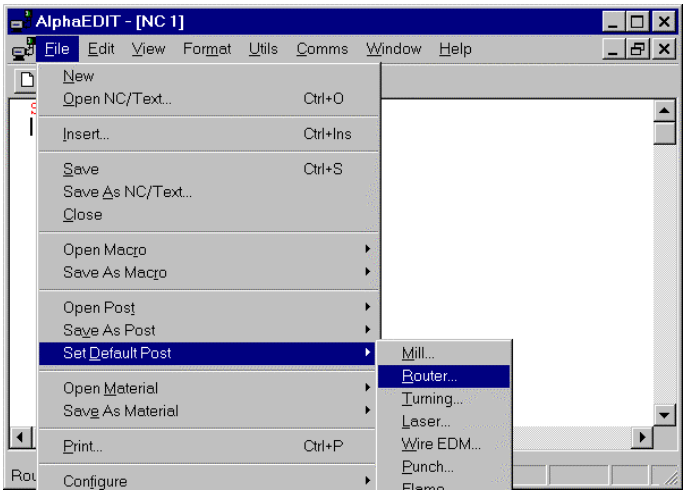
MultiCam offers 2 AlphaCam post processor systems for use depending on the type of post system in the machine. The ***MultiCam*** ATC-ARP post processor interfaces with both ATC and multiple head systems while the ***MultiCam*** ARP post processor interfaces with single head systems.

Multiple Post Systems

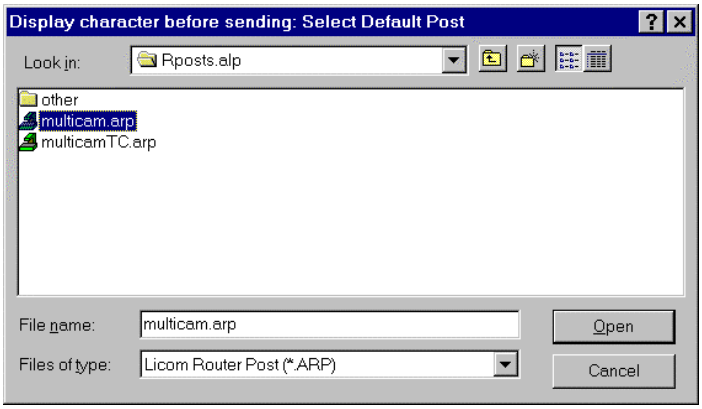
1. Copy the appropriate post processor located in Software Drivers/AlphaCam from the ***MultiCam*** Installation CD into the LICOMDAT/RPOSTS.ALP directory using Windows Explorer.

2. Start the Alpha Edit program from the AlphaCam folder in the Windows Start menu once the post processor is copied.

3. Select Set Default Post/WaterJet from the file menu in Alpha Edit



4. Select the desired post processor from the list. Select *Open*. This will set the selected post processor as the default.



Single Post Systems

1. Contact ***MultiCam*** or one of its authorized distributors for a copy of the OnePost file to use with the single post system.

2. Copy the encrypted OnePost file into the LICOMDAT/RPOSTS.ALP directory. This file has no extension.

3. Verify that AlphaCam completes the auto detect of the single post system post processor once the file is copied into the RPOSTS.ALP directory.

Software

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EnRoute Driver Setup

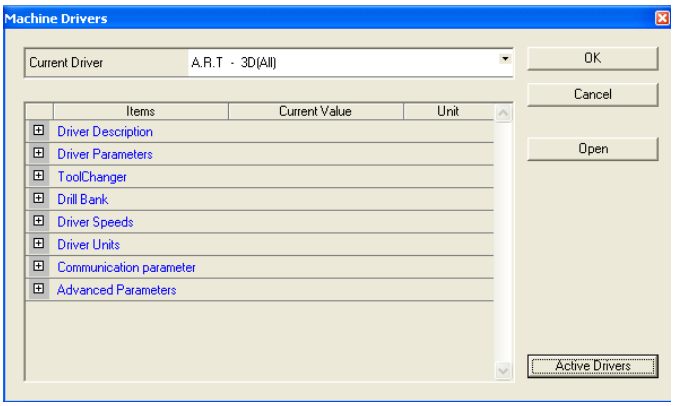
The EnRoute software package is used to assist operators in creating job files for the ***MultiCam*** WaterJet. Each operator must have an installation CD to set up the capability and a dongle to connect with the host PC each time the program is run.

Verifying Computer Compatibility

1. Refer to the EnRoute Recommended System Requirements to make sure the host PC is compatible with the software package.

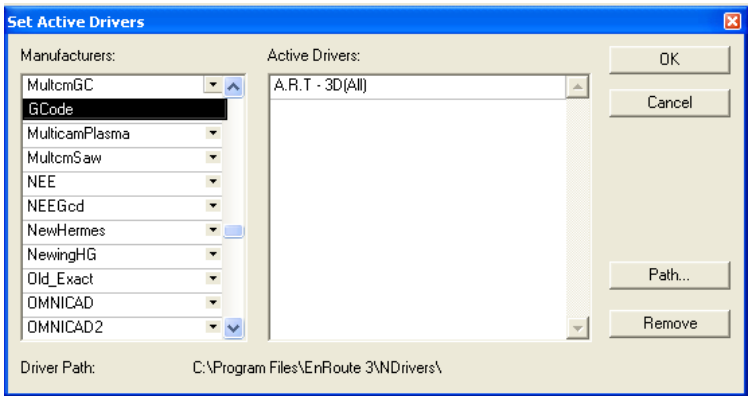
2. Open EnRoute and select Setup/Machine Setup from the toolbar at the top.

3. Click *Active Drivers* in the Machine Drivers dialog.



4. Scroll down on the left side to MultcmGC in the Manufacturers Window.

5. Click on the down arrow to the right of MultcmGC and double-click GCode.



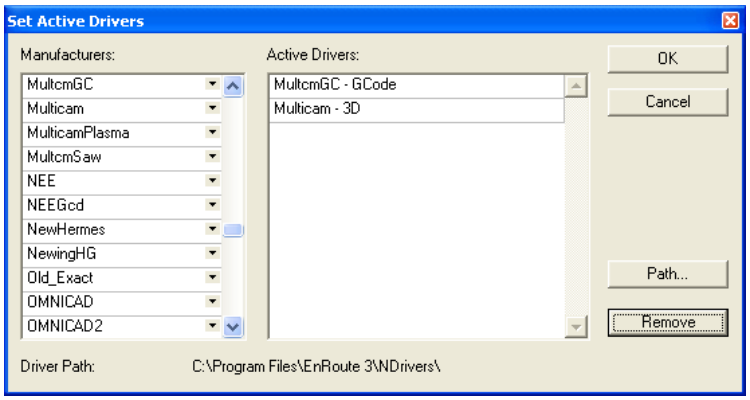
This will add MultcmGC/GCode to the active drivers list on the right.

Selecting the Driver

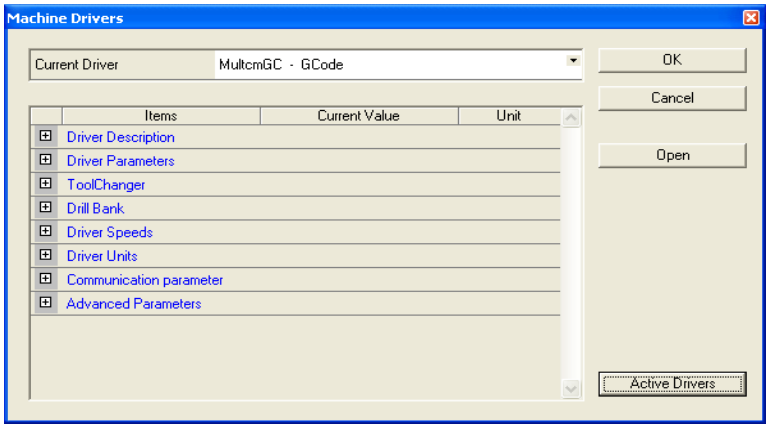
1. Select the appropriate driver based on the system requirements (e.g., Multicam - 3D Driver [HPGL]).
   a. Multicam – 2D uses the ***MultiCam*** 2D Driver for machines that **do not** support 3D and will override all cut parameters set at the keypad.
   b. MultiCam – 3D uses the ***MultiCam*** 3D Driver for machines that **do** support 3D and can be used for cutting bridges, multiple-pass cuts, or 3D machining. This driver will output all cut parameters (e.g., X,Y,Z cut speeds, cut height, lift height, and dwell) and will override any parameters set at the keypad.
   c. MultiCam – No Depth can be used on 2D and 3D ***MultiCam*** machines and will only output the tool path without outputting any cut parameters (e.g., X,Y,Z cut speeds, cut height, lift height, and dwell) regardless of their settings in EnRoute. All settings must be set on the keypad pendant. This driver will not output 3D.

2. Highlight the default driver (e.g., A.R.T. 3D [All]) and select *Remove*.

3. Select *OK* to accept the appropriate ***MultiCam*** GC/GCode driver.



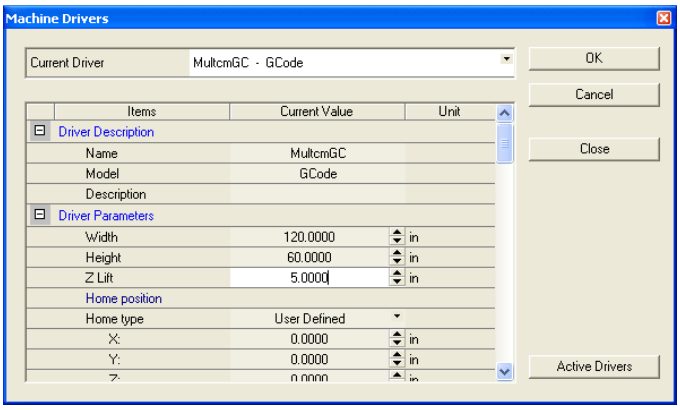
4. Select *OK* to return to the Machine Drivers dialog. The selected driver should be listed at the top.



Adjusting Table Settings

1. Select *Open* to adjust the table settings.

2. Scroll down to Driver Parameters and change the width, height, and Z lift to match the table.
   a. Width = X-axis (front to back; long side of the table)
   b. Height = Y-axis (left to right; short side of the table along the gantry)
   c. Z lift = Z-axis (up and down; Lift Height above the table)



3. Make sure the dimensions are correct before completing setup.

Completing EnRoute Setup

1. Select *OK* in the Machine Driver Dialog to finish the EnRoute Setup.

2. Make no changes to the Driver Units section as the system is configured with default settings and will not work if these settings are changed. The operator can modify the settings under Preferences or the view setup F10.

EnRoute View and Preference Settings

While ***MultiCam*** recommends different settings for standard configurations, the operator is able to review the condition of the cutting sequence and the setup before the cutting sequence begins.

View Options

* Check the screen views to view the associated rulers. The rulers are used to verify size and positioning relative to the location in that Layout View.

* Scroll up, down, left, or right to pan the viewing area without moving the contours.

Toolbars

* Select Setup/Toolbars to choose a toolbar in order to view or hide it. All toolbars will be shown by default.

* Move a toolbar to the desired location by holding down the left mouse button on the dividing line that separates each bar and dragging it. Once the toolbar is close enough to one of the outer edges of the EnRoute window, the toolbar will snap to it, rotating itself accordingly, and the operator may simply release the mouse button.

* Drag the toolbar to the layout viewing area and release it to the title bar at the top. The toolbar can then be grabbed by clicking and holding down the left mouse button.

* Return to the default settings by selecting Setup/Toolbars/Reset to Defaults.

The Preference Settings available in EnRoute 3 (i.e., General, Initialization, Display, Units, Grids, View Setup, Start Points) are used to maximize or speed up the process in which the operator creates a design and applies the tool paths. While the operator has the final say in setting up the program, ***MultiCam*** recommends the following configurations. More information on a particular setting is available by pressing F1 Help, selecting the Search tab, typing in the tab name (e.g., General tab), and double-clicking the tab name under List Topics.

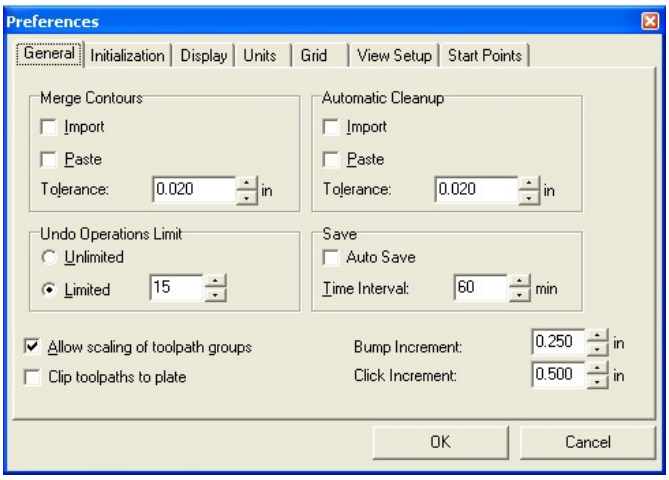
General

* Uncheck Merge Contours and Automatic Cleanup options since they may distort or join contours. Both the Merge and Cleanup options, found under Transform, can be completed once the artwork is successfully brought in.

* Undo Operations Limit due to PC resources and slow operation time. The Limited section should be set around 15 or 20 undos, though the operator would probably be better off starting over if he or she must undo more than 10 times.

* Undo Allow Scaling of Tool path Groups to prevent using up resources. Tool path is included in the size when scaling these groups, and it may be better to delete the tool paths and rescale the contours.

* Determine where Clip Toolpaths to Plate is necessary since it allows the operator to output only the tool path groups that are on the plate. This is useful when creating jobs that are too big for one sheet of material but should be kept together. An out-of-bounds message can occur when the operator is running a file as a closed contour, though parts of the file are not cutting, because either the tool path option is checked or the tool path is hanging off the plate.



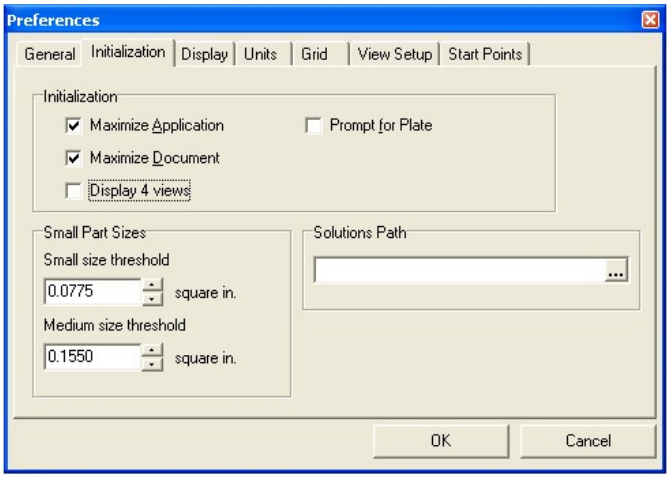
Initialization

* Select Maximize Application and Maximize Document to open the program and any files at maximum window size.

* Reserve the Display 4 Views option until tool paths are in place and a particular view should be seen normally. Display 4 Views will show the top, front, side, and perspective view when opening, importing, or starting a new file.

* Select Prompt for Plate so that the system will prompt at the start of a file to define a plate or material size. A plate does not have to be defined and can be handled when nesting objects or running the 3D simulation. The Clip to Plate option should be unchecked when not defining a plate.

* Avoid changing the default settings for Small Part Sizes.

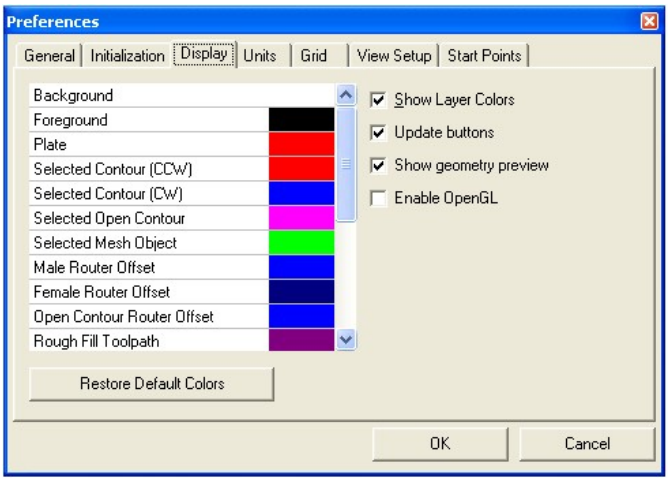


Display

* Avoid changing the Display Settings from the default setting.

* Double-click the individual Colors to make any preferential changes for contour appearance during viewing.

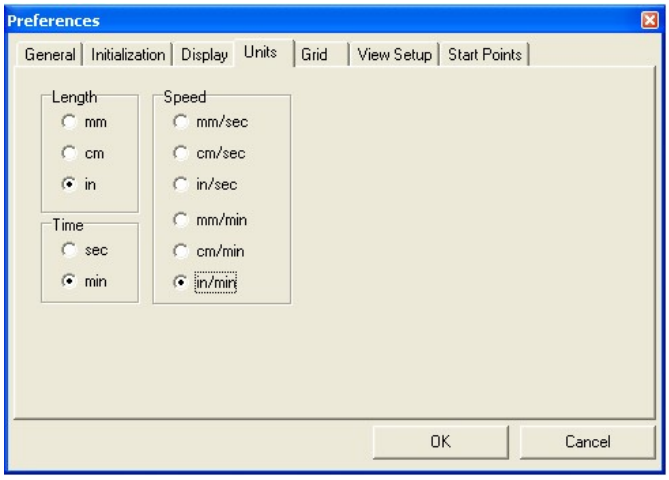
* Leave the 3 options to the far right checked in order to make certain commands user friendly and more functional.



Units

* Adjust the Length, Time, and Speed only when working with metric systems as most companies in the US use inches per minute, which is also the basis for most tool catalog formulas.

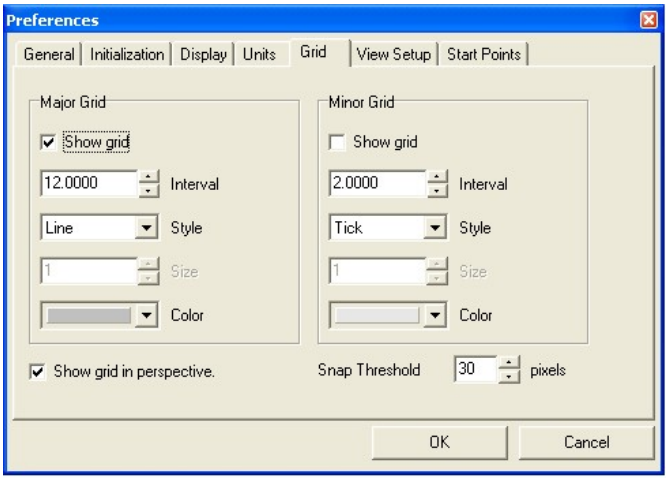
* Change unit measurements in this window only. Operators should avoid making any changes in the Machine Setup/Driver configuration.



Grid

* Change the Major and Minor Grids when creating contours in Contour Creation, which can be turned off when not in use.

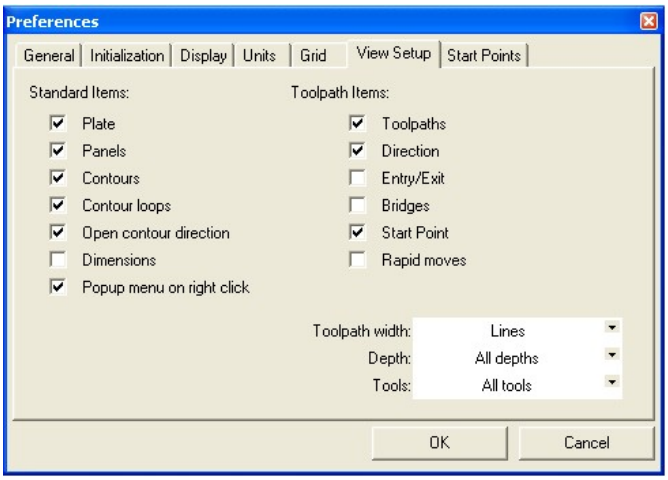
* Review the parameters of the grid. The Interval describes the size of the grid while Size describes the pixel size of the Style.



View Setup

* Adjust View Setup settings to show or hide the listed items when creating contours and tool paths.

* Avoid changing the options in the white window until all paths and options for them have been created. At that point, these settings can be changed to see only certain paths with these 3 options.

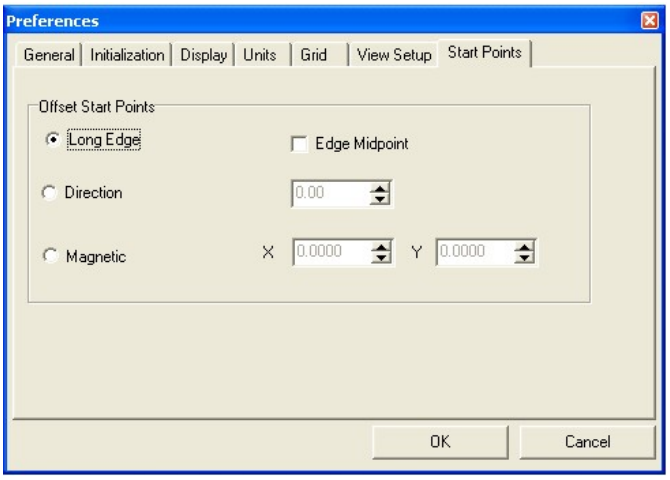


Start Points

* Avoid changing the Start Points settings from the default setting since these offset points can be adjusted manually during the cutting sequence.

* Review the Long Edge configuration as this places the start point on the longest edge of the geometry.

* Select the Edge Midpoint only if the start point should be relocated to the middle of the longest edge.



Software

MultiCam Software

The ***MultiCam*** Software installation CD contains the ***MultiCam*** Motion Controller software, which provides the interface between the computer and the ***MultiCam*** WaterJet. The installation CD also contains machine schematics, software drivers, and a guide with tips on cutting different materials. Before installing ***MultiCam*** Software, customers should make sure there are no other applications open on the computer. Internet Explorer v5.5 or newer is required for this installation.

A. Insert the ***MultiCam*** Installation CD into the CD-ROM drive. This will normally cause the computer to read the CD and then direct the customer through the commands for installation.

B. Follow these steps if the installation does not start automatically:

1. Select the Windows Start button at the bottom left of the screen.
2. Select Run.
3. Click *Browse* on the Run Dialog box.
4. Select the Multicam Installation Folder from the directory.
5. Select Setup.Exe.
6. Click *Open*.
7. Click *OK* on the Run dialog box.
8. Follow the setup menus for a complete installation of the ***MultiCam*** Software.

Software

Motion Controller Utilities

The ***MultiCam*** Software was developed to allow the operator more options and to interface with the newer Windows software. In addition to supporting the DNC function, the ***MultiCam*** Software also has options for digitizing, as well as JobReporter, bar code scanning, and tool diameter compensation. These tools are all written in 32-bit code and run directly from Windows 2000 or higher. Operators can access additional information on these features in C:/Program Files/Machine Tools Suite4.

Suite4

JobNameServer

MotionMechanic

JobEditor

ConnectionManager

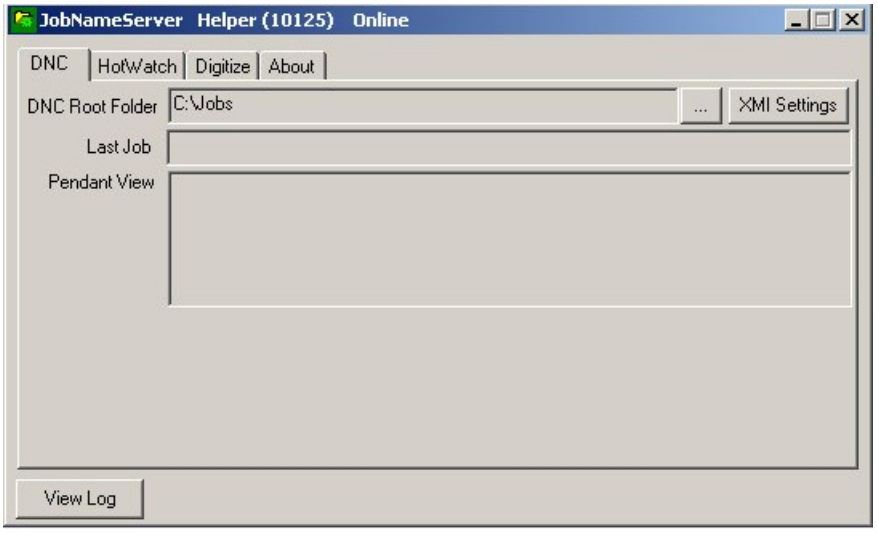
JobReporter

JobConsole

Software

JobNameServer

The JobNameServer program connects the operator with folders on the network or host PC by finding jobs quickly and executing them from the keypad. Other features of JobNameServer can help automate the production process. Operators can click on the tab and start a program or learn about the system.

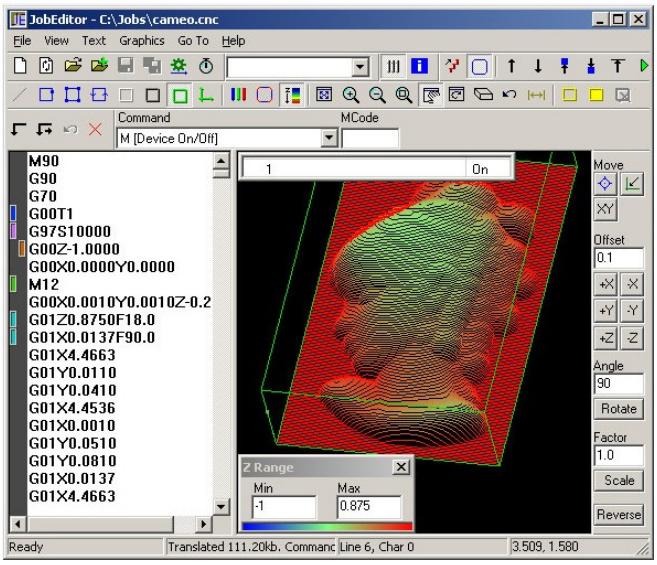


a. **DNC** allows the operator to select and execute jobs from the network or host PC using either a keypad or touch screen interface.
b. **HotWatch** helps automate the production process by monitoring a folder on the network and automatically executing jobs that are placed into that folder.
c. **Digitize** helps operators reproduce 2D and even 3D objects. Not all machines support Digitize, and operators can contact ***MultiCam*** for additional information. A machine supporting Digitize uses special sensors to scan the object and create a job file based on the object. Once the object has been digitized, the job file can be executed as many times as necessary
d. **About** shows the versions of JobNameServer and the associated files used by JobNameServer.

Software

JobEditor

The Job Editor application allows operators to preview and edit jobs through resizing, repositioning, or modifying current job files in any way.



Software

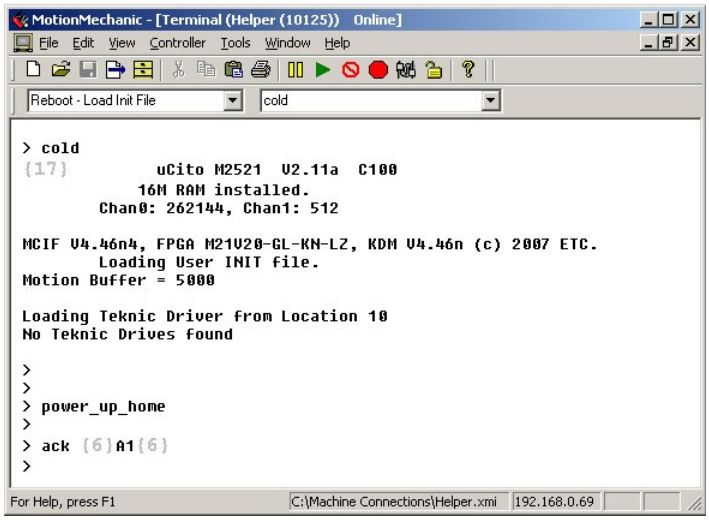
JobReporter

The JobReporter generates reports on machine use. The report results can be filtered and modified to obtain general or specific information about the machine usage.

Software

MotionMechanic

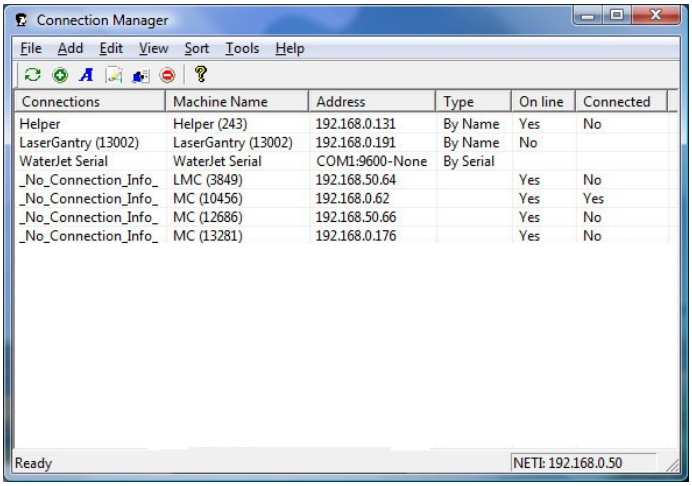
The MotionMechanic application provides the operator with advanced technical control over the use and setup of the motion controller from a host PC.



Software

ConnectionManager

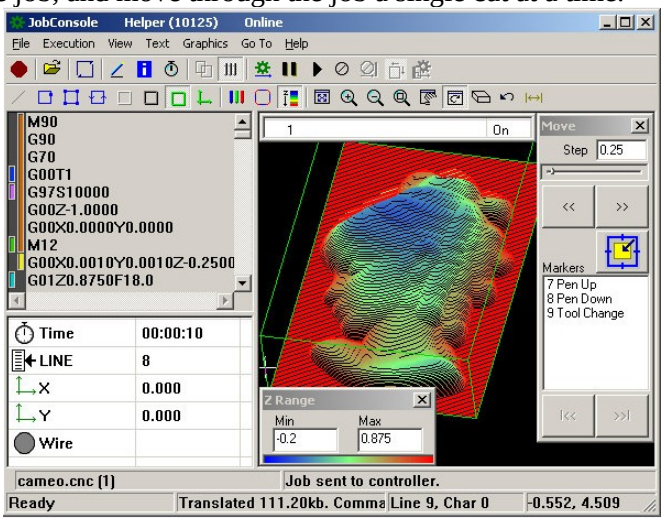
The ConnectionManager helps in creating and configuring the connection between a host PC and the machine tool and has built-in testing features for diagnosing communications issues and sending email correspondence for assistance. Operators can also establish one particular computer to be in charge of all communications, which is helpful if multiple computers are connected to a machine.



Software

JobConsole

The JobConsole program acts as the main graphical interface between a machine tool and the operator, allowing the operator to preview and execute jobs as well as monitor the job progress, pause and resume the job, move to a specific point in the job, and move through the job a single cut at a time.



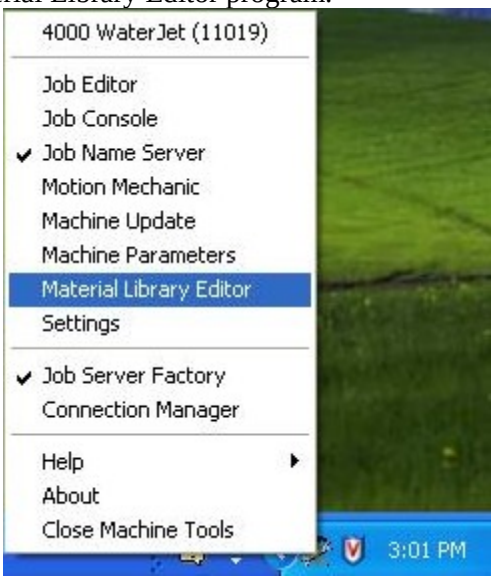
Software

Material Library Editor

The Material Library stores all the cutting parameters for various materials and thicknesses. These parameters are divided into several basic types of material. Under each type of material, operators can load various thicknesses and can attach cutting attributes (e.g., feedrate, cut height) to each type of thickness and material. (The order of the materials indicates the order in which the materials were entered into the Material Library Editor. The system does not alphabetize materials.) The Material Library Editor in Suite4 allows the operator to manipulate the material library in order to add or remove a particular material or material thickness from the stored information on each machine. The following directions address how operators may add a material type to an existing material library on a machine.

1. Leave the keypad at the home screen. Operators should **never use the handheld keypad while the Material Library Editor is open on the computer**. Making changes at this time could delete the material library file from the controller.

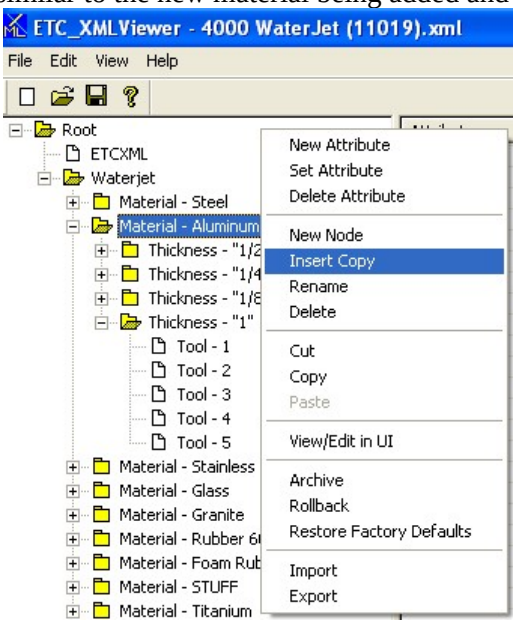
2. Select Machine Tools >> Material Library Editor. From this screen, operators can add, edit, or delete material library information from the Material Library Editor program.



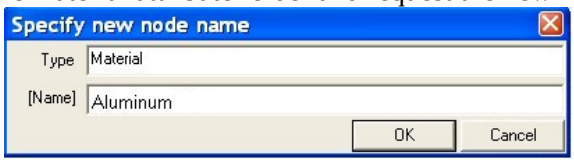
Saving the Material

1. Count the number of material types already saved in the system. This number will be needed in Step #4.

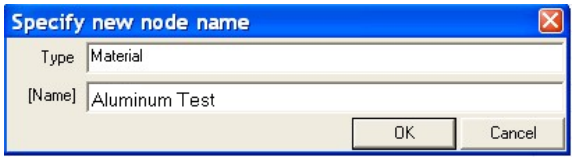
2. Highlight a material type that is similar to the new material being added and select *Insert Copy*.



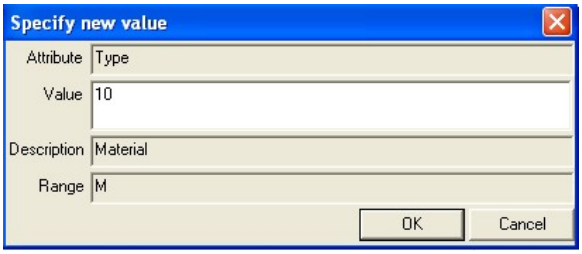
This will automatically open the material attribute folder and request the new node name.



3. Correct the material name to show the new material type (e.g., Aluminum Test) and select *OK*. While operators can enter material types with several characters, only the first ten characters will be visible on the keypad screen.



4. Double-click on the number shown next to Value, correct that number to the next number in the sequence (e.g., 10), and select *OK*.

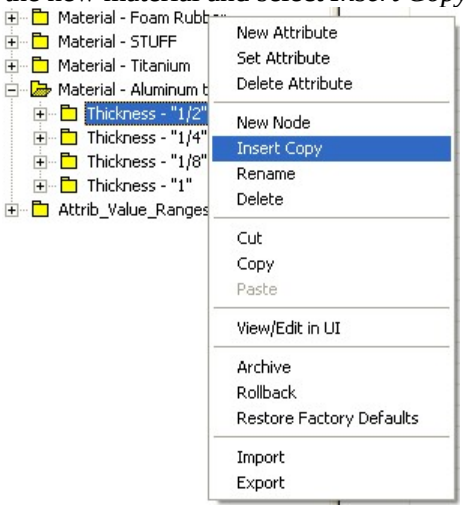


5. Select File >> Save and then exit out of the program.

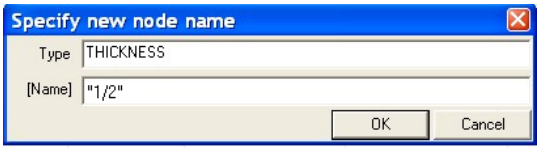
Saving the Material Thickness

1. Open the new material in Material Library Editor. The system will automatically provide material thicknesses and attributes based on the last material added, so operators will need to update the information for the new material.

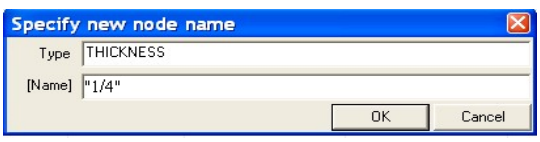
2. Right-click on any thickness under the new material and select *Insert Copy*.



This will automatically open the material attribute folder.

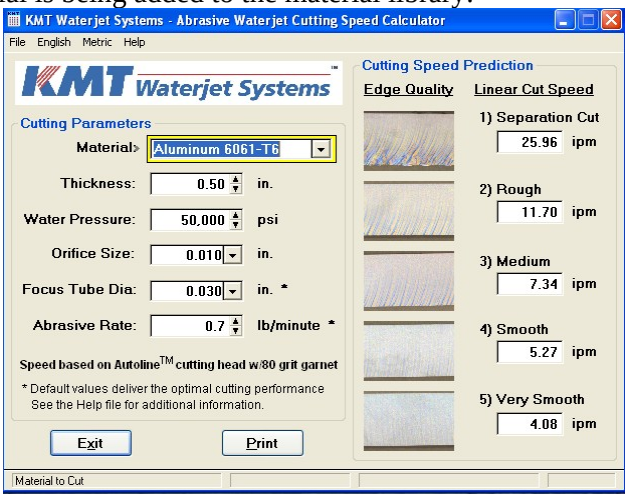


3. Change the name of the thickness if necessary (e.g., “1/2” to “1/4”) and select *OK*. Operators should include the “ ” in the name so that the program will recognize the thickness. Operators can use up to 6 characters for the thickness.

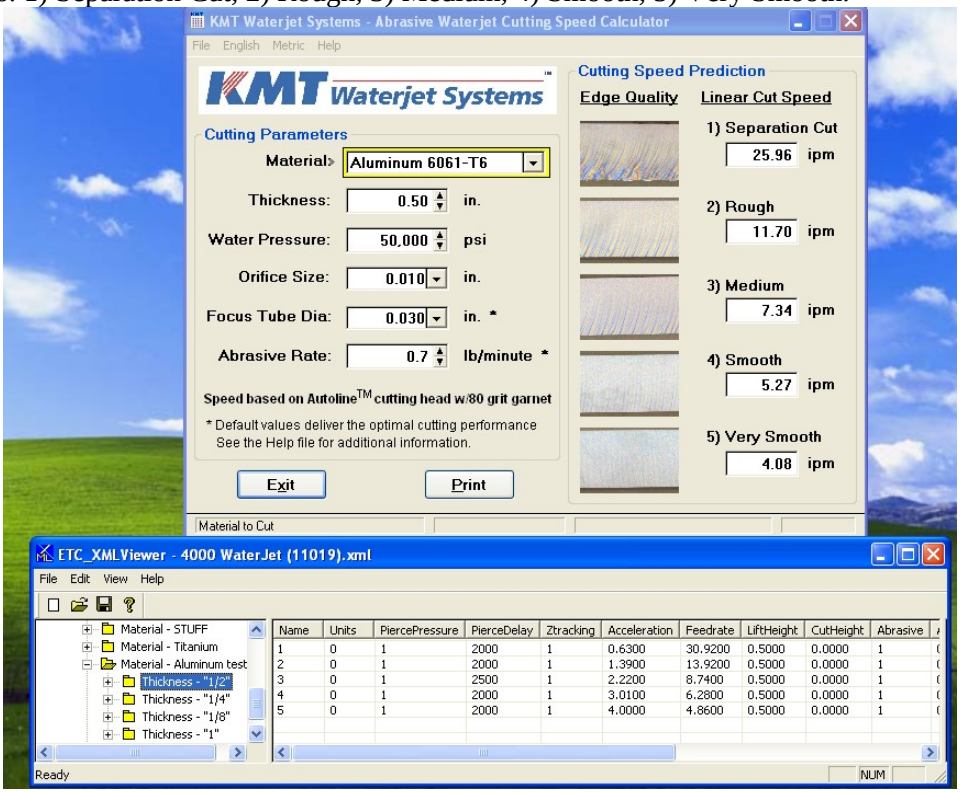


4. Select File >> Save. The tool information will be copied from the previous file.

5. Open the KMT calculator and input the material information (e.g., material type, thickness, water pressure, orifice size, focus tube diameter, abrasive rate). Operators may choose to access this information at a different time or from a different computer, but most people find it to be more efficient to look up and enter the material information when the material is being added to the material library.

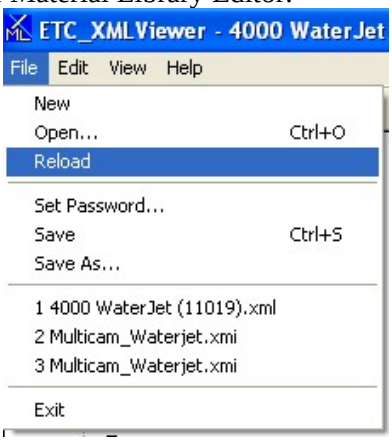

KMT Waterjet Systems - Abrasive Waterjet Cutting Speed Calculator
File English Metric Help
KMT Waterjet Systems
Cutting Parameters
Material: Aluminum 6061-T6
Thickness: 0.50 in.
Water Pressure: 50,000 psi
Orifice Size: 0.010 in.
Focus Tube Dia: 0.030 in. *
Abrasive Rate: 0.7 lb/minute *
Speed based on Autoline™ cutting head w/80 grit garnet
* Default values deliver the optimal cutting performance
See the Help file for additional information.
Exit
Print
Cutting Speed Prediction
Edge Quality
Linear Cut Speed
1) Separation Cut 25.96 ipm
2) Rough 11.70 ipm
3) Medium 7.34 ipm
4) Smooth 5.27 ipm
5) Very Smooth 4.08 ipm
Material to Cut

6. Double-click on the specific item in Material Library Editor to change the value. The KMT calculator shows 5 different values for the 5 types of edge finishes available per material, and those edge finishes correspond with the tool names: 1) Separation Cut, 2) Rough, 3) Medium, 4) Smooth, 5) Very Smooth.


KMT Waterjet Systems - Abrasive Waterjet Cutting Speed Calculator
KMT Waterjet Systems
Cutting Parameters
Material: Aluminum 6061-T6
Thickness: 0.50 in.
Water Pressure: 50,000 psi
Orifice Size: 0.010 in.
Focus Tube Dia: 0.030 in. *
Abrasive Rate: 0.7 lb/minute *
Speed based on Autoline™ cutting head w/80 grit garnet
* Default values deliver the optimal cutting performance
See the Help file for additional information.
Exit
Print
Cutting Speed Prediction
Edge Quality
Linear Cut Speed
1) Separation Cut 25.96 ipm
2) Rough 11.70 ipm
3) Medium 7.34 ipm
4) Smooth 5.27 ipm
5) Very Smooth 4.08 ipm
Material to Cut
ETC_XMLViewer - 4000 WaterJet (11019).xml
File Edit View Help
Material - STUFF
Material - Titanium
Material - Aluminum test
Thickness - "1/2"
Thickness - "1/4"
Thickness - "1/8"
Thickness - "1"
Name Units PiercePressure PierceDelay Ztracking Acceleration Feedrate LiftHeight CutHeight Abrasive
1 0 1 2000 1 0.6300 30.9200 0.5000 0.0000 1
2 0 1 2000 1 1.3900 13.9200 0.5000 0.0000 1
3 0 1 2500 1 2.2200 8.7400 0.5000 0.0000 1
4 0 1 2000 1 3.0100 6.2800 0.5000 0.0000 1
5 0 1 2000 1 4.0000 4.8600 0.5000 0.0000 1
Ready
NUM

7. Select Save in Material Library Editor to save all the changes.

8. Select File >> Reload and close out of Material Library Editor.



Operators may check the keypad to determine that the newly added material is available by completing the following:

1. Reboot the waterjet to reset the material library.
   a. Press Menu to access the menu system.
   b. Press X-axis Jog Arrows until Utility is highlighted in blue.
   c. Press Enter to access the Utility sub-menu.
   d. Press X-axis Jog Arrows until Reboot is highlighted in blue.
   e. Press Enter to access the reboot process.

   f. Press Enter to reboot the machine.

2. Check the Material Library on the keypad to verify that the newly added material is available.
   a. Press Material Library .
   b. Press X-axis Jog Arrows to search through the materials saved to Material Library.

   c. Repeat the above **Saving the Material** if the newly added material does not show in the Material Library.

Saving Material Library Information

Operators can double-check the material library information before each cut by reviewing the information available on the home screen. For example, the bottom row on the display below shows the material type as Aluminum, material thickness as 1/4", and edge quality as Medium.

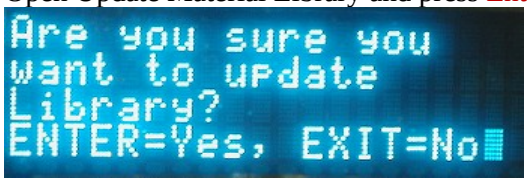
If the operator decides to make changes to the material library information currently available for that material, then he or she should complete the following:

1. Open Params_2D from the keypad.

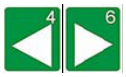
2. Change the parameters as needed (e.g., feedrate, cut height).

3. Scroll down to Update Material Library.

4. Open Update Material Library and press Enter to update the information for that material.



Once the information has been entered into the Material Library Editor and the system has been rebooted, operators can call up a saved material type and then access each of the established thicknesses and cut finishes for that selected material at the home screen by pressing the following hot keys:

Y-axis Jog Arrows  to reach the thickness or finish.

X-axis Jog Arrows to change the value or setting.

Software

JobNameServer Digitize

The Digitize component of JobNameServer allows the operator to Jog the machine around and trace a pattern to record movements that will be played back later, thus simplifying new job file creation, with several Digitize commands.

Using the Digitize functions allows the operator to create a G-Code job file by tracing a pattern. Once the pattern is traced, the job file can be saved and reviewed. Once the file is saved, the job is easily executed using DNC. Digitize is only operable with a ***MultiCam*** WaterJet equipped with the Edge Scan initialization file load in the controller. Software

Digitize Commands

These are the commands and key locations for Manual Digitizing and Rapid Shape™. Only a few of these commands are used in Rapid Shape.

1. **Linear** (Feedrate Up) allows straight line, point-to-point moves in these G-Code Commands: G00 for PU,G01 for PD.

2. **Spline** (Feedrate Up) allows moving a series of points that make up a spline in these G-Code Commands: G25, G26, G27.
   a. Press the Spline key to start the spline command.
   b. Enter as many points as needed around the curve.
   c. Press the Spline key to end the spline command and return to Linear mode.

3. **Arc** (Feedrate Down) allows an arc to be specified in these G-Code Commands: G02 for clockwise, G03 for counter-clockwise. The Arc will be calculated and then presented. After establishing the 3 points of the Arc, the system will return to Linear mode.
   a. Enter 3 points: First, Mid, and End.
   b. Press the Arc key to start the arc command.
   c. Jog to the First point and press Enter .
   d. Jog to the Mid point and press Enter .
   e. Jog to the End point and press Enter .

4. **Back Up** (Increase Power) moves the machine back up to the last PD point entered. Typically 4 points are saved in the point buffer, which only saves PD moves, to allow for backing up and for generating corners.

5. **Set Home** (Set Home) sets the Soft Home to the current position. The current point will become 0,0.

6. **Go Home** (Go Home) moves to the current Soft Home position.

7. **Close Contour** (Drive Enable {3}) moves to the start of the last PD. A contour is defined as a complete PD to PU sequence.

8. **2D/3D** (Move {7}) toggles between 2D and 3D. 2D sets X and Y while 3D sets X, Y, and Z. Currently, only 2D is available.

9. **PD/PU** (Material Library) toggles between PD and PU mode in these G-Code Commands: M11 for 2D PD, M21 for 2D PU, M12 for 3D PD, M22 for 3D PU. A point will not be issued at this time as this command only toggles the state. The PD or PU command will be generated on the following move. This allows the operator to produce only one command even if the PD/PU key is pressed multiple times.

10. **Exit** (Cancel/Exit) ends the Job and exits Digitizing in the G-Code Command M02. If the current PD/PU state is PD, then an M21 will be issued to lift the pen prior to exiting.

11. **Enter** (Enter) enters a point. When entering a point in Linear mode, either a G00 or a G01 will be output. The status of the PD or PU will determine which command is generated. A G27 will be output in Spline mode.

12. **Flush Buffer** (Increase Power) outputs the current point buffer to the host computer. When setting points, the operator can save several points in a point buffer prior to being sent so they are not immediately visible in the Digitize Window. The Flush Buffer key will flush this buffer, outputting all points in the buffer so they can be viewed in the Digitize Window. It is not necessary to flush the buffer as the system will automatically do this at the end of the job.

Software

Manual Digitize

The Manual Digitize function creates a G-Code file one line at a time. When manually digitizing, operators must be sure to enter every point required without overlooking the first Pen Down (PD) move or the final Pen Up (PU) move on a new contour.

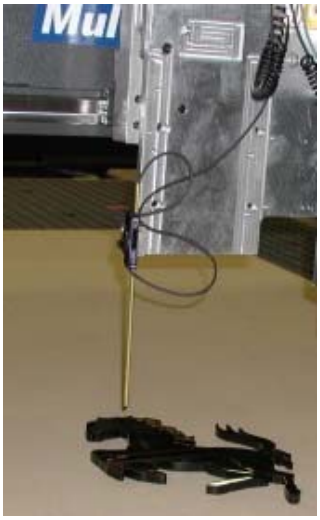
The job will be either shown in the Digitize window. Digitize files can also be imported into a CAD/CAM program or directly run back on the machine.

1. Make sure JobNameServer is running on the computer. If the icon is not visible in the Windows system tray, the small box in the bottom corner by the system clock, then the operator may select JobNameServer from the ***MultiCam*** folder under the Windows Start menu.
2. Press Go Home or move to a location where 0,0 will be located and press Set Home .
3. Press Menu to access the menu system.
4. Press Jog Arrows until the blinking cursor is over the “D” in Digitize.
5. Press Enter to start digitizing.
6. Enter a numerical name for the file to be created. When executing or importing the file, the operator must include a number before “dig.cnc” (e.g., 1234dig.cnc).
7. Jog to the start of a contour and press Enter . This carries the PU move to just above the first location. Digitize starts in PU mode, so the first move is a PU move.
8. Press Material Library . This enters a PD move at the same X,Y.
9. Stay in PD mode.
10. Jog around the contour and press Enter to add new points.
11. Press Drive Enable near the end of the contour. This will position the head assembly directly over the first point in the contour.
12. Press Enter to enter the point.
13. Press Material Library to toggle to PU.
14. Jog to the next contour and repeat the process until all contours have been digitized.
15. Press Go Home to go to 0,0 at the end of the job.
16. Press Exit to end the job.

Software

Rapid Shape

The ***MultiCam*** Rapid Shape can automatically digitize both simple and complex shapes. Mounted on a ***MultiCam*** WaterJet, this device enables the waterjet to automatically follow an edge of a pattern or object placed on the machine bed and record the outline on the host PC.



Easy and accurate calibration makes digitizing a variety of materials possible with digitizing speeds typically of 60 inches/minute. The Rapid Shape software generates a G-Code file for importing to many CAD/CAM systems.

Software

Rapid Shape Tips and Troubleshooting

The tips available for Rapid Shape are updated periodically and can also be found on the ***MultiCam*** web site.

1. **Scan rate** sets the speed the system will auto scan. The default setting is 2.0” per second. A slower scan rate will result in slightly better accuracy at a longer time, while a faster rate will take less time but have less accuracy.

2. **Step Size** sets the distance along a line between 2 scanned points. The default setting is 0.15”. The step-size distance should be small for detailed parts but can be larger for parts with less detail.

3. **Scan Mode** sets the style of scanning to be completed. Operators should select EDGE for templates and LINE for drawings or patterns.

4. **Add Corners** can be adjusted for corners when corners are detected during the cutting sequence.

5. **Output START** places “START” at the beginning of the G-Code file, which is required by some software packages due to the importance of the G-Code file.

Rapid Shape will exit if one of the following occurs:

* **The module is not loaded.**
  The operator should load the module by selecting JobNameServer from the ***MultiCam*** folder under the Windows Start menu. Once the module is loaded, the waterjet should be calibrated to the material to be scanned.

* **Rapid Shape found the start of the contour.**
  The operator should move to the next contour to continue or cancel the sequence.

* **The operator pressed** Pause .
  The operator can move farther along the contour and restart.

* **The system could not find the edge.**
  The operator can move farther along the contour and restart.

* **The system lost a good edge.**
  The operator can move farther along the contour and restart.

* **Rapid Shape has too many points.**
  The operator can decrease the step size and start over.

* **The previous point is too close to Auto Scan.**
  The operator can move farther along the contour and restart.

Software

Using Rapid Shape

Once JobNameServer has been verified on the system and the waterjet has been enabled, Rapid Shape can be used in conjunction with the cutting sequence.

1. Make sure JobNameServer is running on the computer.
2. Press Go Home or move to a location where 0,0 will be located and press Set Home .
3. Press Menu to access the menu system.
4. Press Jog Arrows until the blinking cursor is over the “D” in Digitize.
5. Press Enter to access the Digitize sub-menu.
6. Set the 5 options for Rapid Shape: Scan Rate, Step Size, Scan Mode, Add Corners, and Output Start.
   a. **Scan rate** sets the speed the system will auto scan. The default setting is 2.0” per second.
   b. **Step Size** sets the distance along a line between 2 scanned points. The default setting is 0.15”.
   c. **Scan Mode** sets the style of scanning to be completed. Operators should select EDGE for templates and LINE for drawings or patterns.
   d. **Add Corners** adjusts for corners when detected by the system.
   e. **Output START** places “START” at the beginning of the G-Code file, which is required by some software packages due to the importance of the G-Code file.
7. Move the cursor to “Start Digitize” and press Enter .
8. Enter a numeric file name and press Enter .
9. Press Jog Arrows to place the **center of the waterjet cutting head** over the front right corner of the material.
10. Press Set Home .

11. Press Enter to set Home. This will store the absolute X and Y coordinate locations in the controller's memory.

12. Press Jog Arrows to move the head assembly to the edge of the pattern or template. This sets the direction Rapid Shape will go around the contour of the pattern or template.

13. Press Five to start the Auto Scan. The system will move back and forth for a few seconds to calibrate and then start moving in the set direction along the contour of the pattern. The scanner will continue along the contour until the start point is reached, unless the operator interrupts the sequence.

    a. Press Pause to stop the scanning process if needed.

    b. Press Enter to access manual mode. The operator may continue Auto Scan by moving the head assembly forward along the contour at least the step-size distance, while keeping the focus tube close to but not actually on the material, and pressing Auto Scan. The system will move back and forth to calibrate again before continuing around the contour. At the end of the Auto Scan, Digitize will be left in a PU move.

14. Repeat for any additional contours. The system will accept as many contours as necessary.

15. Press Cancel to exit out of Digitize mode once the part is completely scanned. The scanned file will be displayed in the preview window.

    Once the scanned file has been completed, it can then be either imported into a CAD/CAM package or executed at the machine through DNC, though the system will **not** complete tool offsets if the operator executes the scanned file from the machine.

JobNameServer HotWatch

The HotWatch component of JobNameServer allows job files to be automatically transferred to the ***MultiCam*** WaterJet by monitoring a specified directory on the computer. Whenever a file with a known extension appears in this Inbox directory, HotWatch will transmit it to the waterjet and then move the file from the Inbox directory to the Outbox directory. These directories do not have to be located on the local hard drive but can exist as shared folders on a local or wide area network. HotWatch can be configured to check for new files at specified intervals to help minimize network traffic.

The full path of the Inbox and Outbox directories is displayed in the HotWatch applet, and these directories can be changed at any time by clicking on the Browse button to select another path. The HotWatch Status informs the operator of all activities that HotWatch is performing.

HotWatch does not automatically monitor the Inbox directory or transmit job files. Operators must manually set up HotWatch and activate this function. Software

JobNameServer JobQueue

The JobQueue component of JobNameServer allows jobs for production runs to be created and set up. The job file must be created and started before JobQueue will execute, and the operator can set up JobQueue in the JobQueue window. Once these settings are made and JobQueue is started, the operator will be prompted to start each job after seeing the repetition number of the job being executed. This allows the operator to move to another Home position or unload and load material before the cutting sequence begins. Software

HPGL Command Support

The ***MultiCam*** control system internally translates HPGL. Feedrate, Cut Height, and Lift Height can be set by the file or by the machine's keypad interface. If the Feedrate, Cut Height, and Lift Height are set at the machine prior to the file being sent, the file will override all those values set at the machine. If no value is sent in the file, then the machine will use the value programmed at the keypad. The control system ignores the HPGL VS command.

At the beginning of the file, the controller **must** be sent the IN command to begin processing plot commands. If the letter I is **not** the first character sent, then a linefeed or semi-colon must be sent to re-initiate the sequence. A semi-colon must follow the IN command. If any other character is sent during this sequence, then the complete sequence must be restarted. This command sequence must be sent again if an SP or an SP0 command is sent. The recommended initialization string is ";IN;" and the recommended termination string is "SP0;". All files should be written in absolute mode. Some of the early systems do not support relative arc commands.

HPGL Resolution = 1016 inch =40 Metric

The following pages contain all of the supported commands. A semi-colon or a linefeed **must** terminate all commands, and spaces **cannot** be substituted for required commas in the syntax of a command. All Z-axis arguments are only valid if the 3D mode is set. All commands are integers unless otherwise specified.

Help documents on the HPGL and CNC systems are located in the ***MultiCam*** folder, and operators can access this folder through either Start/Programs/Multicam/Help/Translated PLT Help or Start/Programs/ Multicam/Help/Translated CNC Help.

Example Files

Multi Tool File

```
;IN;PU;ZZ0;
PA0,0;
TCTool 1;
ZD127;ZU400;
PA1016,1016;PD1016,1016;PD11176,1016;
PD11176,11176;PD1016,11176;PD1016,1016;
PU;TCTool 2;
ZD127;ZU400;
PA2032,2032;PD2032,2032;PD10160,2032;
PD10160,10160;PD2032,10160;PD2032,2032;
PU;TCTool 3;
ZD127;ZU400;
PA3048,3048;PD3048,3048;PD9144,3048;
PD9144,9144;PD3048,9144;PD3048,3048;
PU;PA0,0;
SP0;
```

Automatic Tool Changer File (or Multi Head)

```
;IN;PU;ZZ0;
PA0,0;
SP3;
ZD127;ZU400;
PA1016,1016;PD1016,1016;PD11176,1016;
PD11176,11176;PD1016,11176;PD1016,1016;
PU;SP1;
ZD127;ZU400;
PA2032,2032;PD2032,2032;PD10160,2032;
PD10160,10160;PD2032,10160;PD2032,2032;
PU;SP2;
ZD127;ZU400;
PA3048,3048;PD3048,3048;PD9144,3048;
PD9144,9144;PD3048,9144;PD3048,3048;
PU;PA0,0;
SP0;
```

Arc File

```
;IN;ZZ0;SP1;
PA1360,2450;ZD0.500000;PD;
AA1270,2540,360.000000;PU;
PA2010,3048;PD;PA1292,3766;PU;
PA2630,3720;PD;AA2540,3810,360.000000;
PU;PA3290,4263;PD;PU;PA4154,3720;
PD;AA4064,3810,360.000000;
PU;PA4902,4263;PD;PU;PA5678,3720;
PD;AA5588,3810,360.000000;PU;
PA4064,2921;PD;PA2540,2921;
AA2540,2540,180.000000;PA5588,2159;
AA5588,2540,180.000000;PA4064,2921;
PU;PA4154,1180;PD;AA4064,1270,360.000000;
PU;PA5678,1180;PD;AA5588,1270,360.000000;
PU;PA6948,2450;PD;AA6858,2540,360.000000;
PU;PA2630,1180;PD;AA2540,1270,360.000000;
PU;PA7747,2540;PD;AA5588,2540,-90.000000;
PA2540,381;AA2540,2540,-
180.000000;PA5588,4699;
AA5588,2540,-90.000000;PU;PA8128,0;SP0;
```

Sample 3D file

```
IN;ZZ1;PU;SP1;
PA5000,5000,-200;
PD5000,5000,500;
PA5000,15000,1000;
AA10000,15000,-180;
PA15000,5000,750;
AA10000,5000,-180;
PA5000,5000,-200;
PU;SP0;
```

Multi Pass File without Lifting the Z

```
;IN;PU;
PA0,0;
SP1;
ZD100;
PA1016,1016;
PD1016,1016;PD11176,1016;
PD11176,11176;PD1016,11176;PD1016,1016;
ZD200;
PD1016,1016;PD11176,1016;
PD11176,11176;PD1016,11176;PD1016,1016;
ZD300;
PD1016,1016;PD11176,1016;
PD11176,11176;PD1016,11176;PD1016,1016;
ZD400;
PD1016,1016;PD11176,1016;
PD11176,11176;PD1016,11176;PD1016,1016;
PU;SP0;
```

Software

HPGL Commands

Initilization

IN instructs the controller to begin processing the HPGL plot file. Without this, the commands in the file are received but never executed. If multiple IN commands are found during the execution of the file, the controller performs a Pause/Cancel operation. All motion from the previous job that has yet to be executed is lost, and the information is executed.

When the IN command is executed, the HPGL 3D mode is cleared. The 3D mode can be reset using the ZZ command. A Pen Up (PU) command will be executed before the system executes the first HPGL move command.

ZZ (0,1) establishes that a value of 0 sets 2D mode and a value of 1 sets 3D mode. In 2D mode, all commands must have 2 axes, while all commands must have 3 axes in 3D mode.

Motion

PA[X,Y][,Z] moves to an absolute HPGL position and sets absolute mode for future PU and Pen Down (PD) commands. If no arguments follow the command, only absolute mode is set.

PD[X,Y][,Z] executes a PD then moves to the requested position, if one is specified. This position is based on whether absolute or relative mode is set. The Feedrate Override knob is turned ON.

PU[X,Y][,Z] executes a PU then moves to the requested position, if one is specified. This position is dependent on whether absolute or relative mode is set. The Feedrate Override knob is turned OFF.

AA X Ctr,Y Ctr,Angle is a floating point requiring a non-integer value that draws an arc with its center at (X, Y). A positive angle creates a counter-clockwise arc.

ZA Z moves the Z-axis to the absolute position specified. This feature is for both 2D and 3D modes.

Speed

SF[XY-rate],[Z-rate], floating points, sets the feedrate for the machine tool during PD. All rates are in mm/sec. The Z rate applies to the plunging feed rate of the Z-axis. In 3D mode, Z-axis rate is not used.

Other

SP[0, 1, 2, ... 8...] selects a new tool for use. If zero or no pen number is given, the controller performs an end of file (EOF) command, and no motion is executed until a new IN command is received.

ZD Z, floating point, sets the distance from the surface for the Z-axis to move down on a PD command (Depth). Changing the ZD value will change the depth on all following PD commands and not used in 3D.

ZU Z, floating point, sets the distance from the surface for the Z-axis to move up on a PU command (Lift Height). Changing the ZU value will change the Lift Height distance on all following PU commands. The value set with this command is **not** used when running in 3D mode.

MultiCam M- and G-Code Support

The following table lists the supported M and G Codes for the MultiCam Controller. Parameters within brackets are optional. The fields represented by “d.d” may be any decimal number, and fields represented by “d” may be any positive integer. All lines of machine code must start with either an M Code or a G Code.

G00 [Xd.d] [Yd.d] [Zd.d] [Fd.d] [Td] [Ctext string] - High speed move (slew)
G01 [Xd.d] [Yd.d] [Zd.d] [Fd.d] - Linear move (machine)
G02 [Xd.d] [Yd.d] [Zd.d] [Id.d] [Jd.d] [Kd.d] [Fd.d] - CW 2D circular move
G03 [Xd.d] [Yd.d] [Zd.d] [Id.d] [Jd.d] [Kd.d] [Fd.d] - CCW 2D circular move
G04 Fd.d - Dwell (seconds)
G17 - Specify XY plane for helical
G18 - Specify ZX plane for helical
G19 - Specify YZ plane for helical
G37 - Find home
G62 - Clear soft home
G70 - English programming (inches)
G71 - Metric programming (mm)
G72 [Xd.d] [Yd.d] [Zd.d] [Id.d] [Jd.d] [Kd.d] [Fd.d] - CW 3D circular move
G73 [Xd.d] [Yd.d] [Zd.d] [Id.d] [Jd.d] [Kd.d] [Fd.d] - CCW 3D circular move
G74 - Incremental mode for G02/03 arcs
G75 - (G90/G91) mode for G02/03 arcs
G83 Rd.d Zd.d Dd.d [Fd.d] - Peck drill
G90 - Absolute coordinate mode
G91 - Incremental coordinate mode
G92 [Xd.d] [Yd.d] [Zd.d] - Set soft home
G97 Sd - Set spindle speed (rpm)
M00 - Program pause
M01 - Optional pause
M02 - Program end
M11 - 2D device on (like HPGL PD)
M21 - 2D device off (like HPGL PU)
M12 - 3D device on
M22 - 3D device off
M30 - AUX 4 on not affected by the Pause button
M31 - AUX 4off not affected by the Pause button
M90 - Program start
M99 - Exit CNC interpreter

The following table lists the letters used to denote various arguments in ETC CNC version 1.0.

C - Tool change operator message (used in G00)
D - Peck drill delta (used in G83)
F - Feed rate (used in G00, G01, G02, G03, G72, G73, G83)
F - Dwell (used in G04)
G - Preparatory function
I - Circular interpolation value in X dimension (used in G02, G03, G72, G73)
J - Circular interpolation value in Y dimension (used in G02, G03, G72, G73)
K - Circular interpolation value in Z dimension (used in G02, G03, G72, G73)
M - Miscellaneous function (control function)
N - Sequence number
R - Beginning Z motion dimension (used in G83)
S - Spindle rpm (used in G97)
T - Tool change (used in G00)
X - X motion dimension
Y - Y motion dimension
Z - Z motion dimension

The following is a waterjet cut 5” square with 2” center circle with Lead-ins and Lead-outs.

```
M90
G90
G75
G00 T1
G00  X1.976294 Y2.685
M11
G03  X1.8999 I1.938097
G03  X3.8401 I2.87
G03  X1.911474 Y2.834403 I2.87
G03  X1.900364 Y2.714995 I2.87 J2.685
G03  X1.962027 Y2.649395 I1.963995 J2.713027
M21
G00  X0.22 Y5.215
M11
G01  X0.34
G01  X5.4
G01  Y0.155
G01  X0.37
G01  X0.34
G01  Y5.065
G01  Y5.215
G01  Y5.315
M21
M02
```

The following is a waterjet cut 5” square with 2” center circle with Lead-ins, Lead-outs, and Tool Comp.

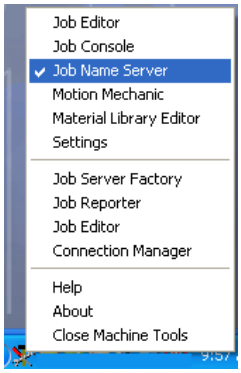
```
M90
G90
G75
G00 T1
G00  X1.976294 Y2.685
G41
M11
G03  X1.8999 I1.938097
G03  X3.8401 I2.87
G03  X1.911474 Y2.834403 I2.87
G03  X1.900364 Y2.714995 I2.87 J2.685
G03  X1.962027 Y2.649395 I1.963995 J2.713027
M21
G40
G00  X0.22 Y5.215
G41
M11
G01  X0.34
G01  X5.4
G01  Y0.155
G01  X0.37
G01  X0.34
G01  Y5.065
G01  Y5.215
G01  Y5.315
M21
G40
M02
```

Software

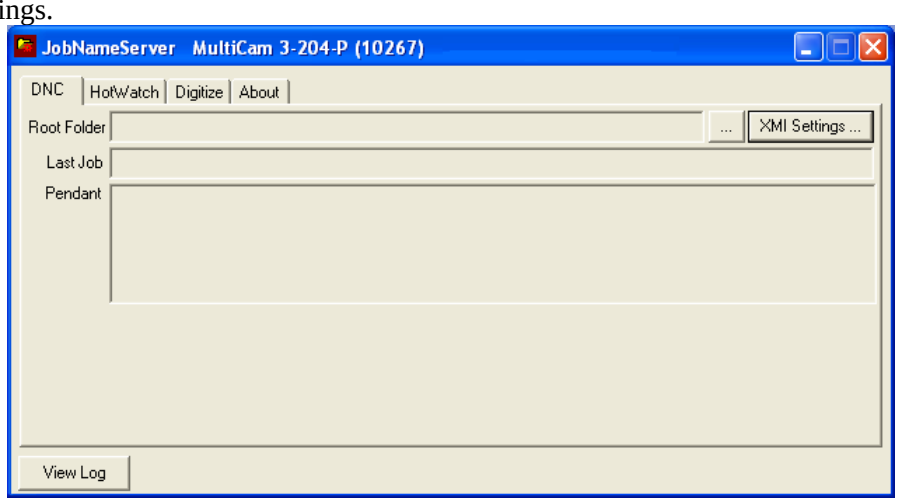
Mapping M Code to Output

Operators can add M Codes to an output on their existing machines, assign the code to a particular device, and set the active status by completing the following steps:

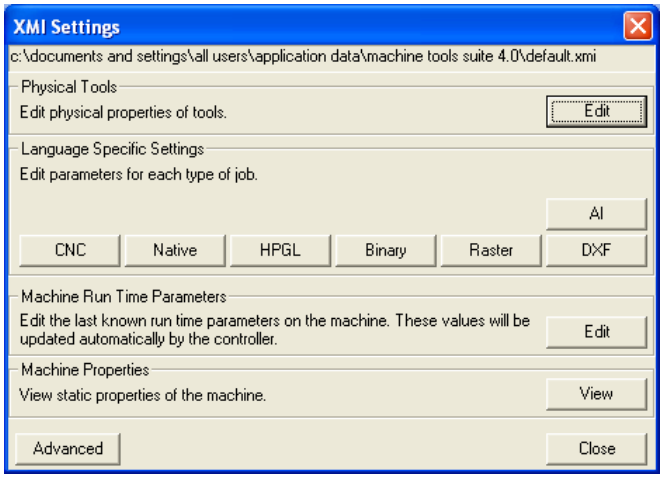
1. Open MachineTools and select JobNameServer.



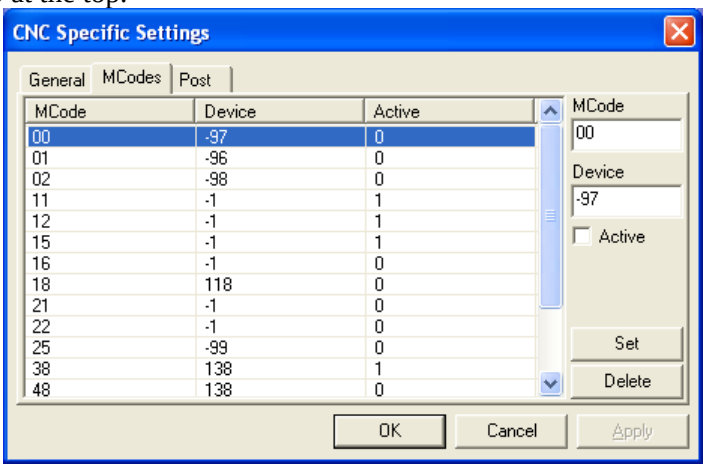
2. Select XMI Settings.



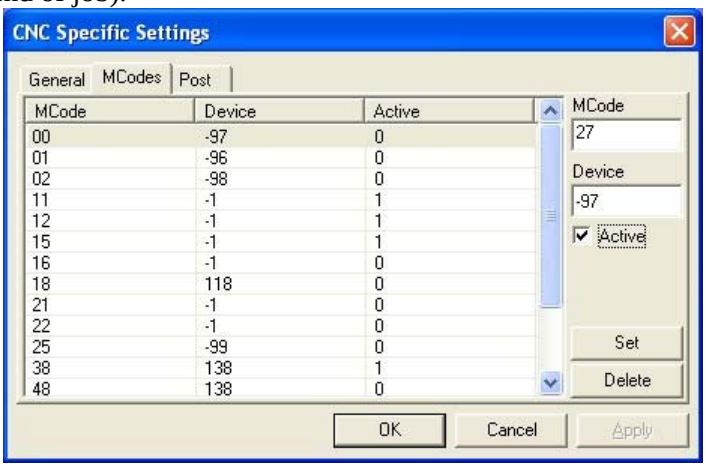
3. Select CNC.



4. Click on the MCodes tab at the top.



5. Enter the M Code (e.g., 27), correct the device as needed, set the status to Active by clicking in the check box, and select *Set*. **Active** indicates a motion command (e.g., start spindle) while **Inactive** indicates a non-motion command (e.g., end of job).



Any M Code, including M12, can be mapped per the operator's preference; however, JobConsole treats the M12/M22 coding specifically for the start/end of a contour.

6. Download and store an MCode_Device_Map.uc file to location 3. For assistance on any of these steps, please contact ***MultiCam*** Tech Support.

Operators may also modify or delete M Codes from this same dialog.

Modify - Highlight an existing M Code, make changes (e.g., Device -1 instead of -97), and select *Set*.

Delete - Highlight an existing M Code and select *Delete*.

Software

Glossary

The following words are most commonly used in reference to the waterjet and associated activities.

Axis - A direction in a coordinate system. ***MultiCam*** WaterJets have 3 axes: X, Y, and Z.

Axis Motor - A motor that causes motion in a particular axis.

Bearing Car - The bearing on which an axis moves along a rail, also known as a bearing truck. There are 2 bearing cars for each rail.

Bearing Rail - The rail on which the bearing cars ride. There are 2 rails for each axis.

Bevel - The angularity between the material surface and the cut edge.

Bite Size - The depth of each pass, used in multipass.

Climb Cut - A direction the waterjet moves along a cut to produce a climbing motion. For a closed contour, the climb cut is clockwise on the outside of the cut and counter-clockwise on the inside of the cut.

Consumables - The components that are used up in the cutting process.

Conventional Cut - The opposite cut of a climb cut, or closed counter-clockwise on the outside of the cut and clockwise on the inside of the cut.

Cut Height - A Hot Key function that sets the height of the cut. Cut Height refers to the Z-axis distance the stream will go below the surface of the material during a cut.

Cut Speed - A Hot Key function that sets the speed of the cut, also known as X & Y Feedrate.

DNC - (Distributed Numerical Control) allows the controller to access sub-directories on the hard drive of a host PC and is used to transfer files from the PC to the controller.

DNC Log - A listing of all activity completed by the DNC and kept by the DNC.

Dry Run - A controller function that will execute a file with no Z-axis movement. Dry Run is used to show the operator where the waterjet cutting head will go during the cutting sequence.

Emergency Stop - The red mushroom button located on the keypad, as well as on the side of the waterjet and on the operating station, used to remove power from the machine excluding the controller board and limit switches.

External Halt - The keypad display that appears when power is applied to the system with the Emergency Stop button pushed in on the keypad pendant.

Feedrate Override - A Hot Key used to adjust the cutting feedrate of the system while a file is being executed.

Fiducial - A reference mark, or dot, used in MultiVision that allows the CNC machine to recognize the orientation of the material and adjust the cut file accordingly.

Firmware - The operating system of the controller that should only be loaded when instructed by ***MultiCam***. Firmware contains all of the low-level commands and is the first level of controller software.

Flash RAM File - A file containing all of the machine parameters of a particular waterjet. Settings such as table size and resolution are located in the Flash RAM File, which is the third level of controller software.

Gantry - The mechanical part of the waterjet, also known as the bridge, which moves the head assembly from the front to the rear of the table.

G Code - The machine code language used by the controller to execute motion commands.

Hard Home Position - The home position determined by the location of the targets and limit switches, typically the front right side of the table.

Head - A reference to the particular cutting tool (i.e. Spindle, Plasma or Oxyacetylene torch, Laser, WaterJet).

Head Mode - A designation for multiple head machines, either All or Auto.

Hot Keys - The one-touch keys on the keypad that perform controller functions.

HPGL - The machine code language that the system executes as a file.

Init File - The second level controller software that contains high level commands.

JobNameServer - The motion controller utility program used to communicate between the controller and the host PC in Suite4.

Kerf - The width of the cut.

Keypad - The part of the pendant with the grid of Hot Keys.

Lift Height - The Z-axis distance between the bottom of the waterjet and the material. The Lift Height is also the location of the waterjet during a slew move.

Menu System - The commands that are not assigned to Hot Keys.

Operating Station - The stand-alone board separate from the machine and the keypad that allows the operator to turn on auxiliary systems or access dual systems if applicable.

Park - The function used in all 3 axes to place the waterjet cutting head assembly at the farthest point away from the material for loading and unloading.

Pause - The yellow button on the keypad that puts the controller into Pause mode where action is momentarily stopped and can be restarted at the keypad.

Pendant - The control module consisting of the keypad and mechanical inputs.

Programmable Soft Home - The 9 possible Home positions that the operator can store to be recalled at a later time.

Proximity Restart - The controller function that allows the operator to restart a file along any cut move after an interruption such as power outage.

Rack and Pinion - A system of transferring movement from the rotation of the motors to the linear movement of the system by way of gears.

Self Test - A controller function that allows the system to test itself. The self test is accessed from the menu items.

Serial Cable - The RS232 cable used to transfer data from the host PC to the controller.

Servo Drive - The Servo amplifier used to move the servo motors.

Servo Motor - The axis motor on a servo system.

Side Cover - The covers on each end of the gantry protecting the X-axis motor and limit switches.

Slew - A non-cutting movement of the system above the material at maximum speed.

Soft Home Position - Any set Home position used as the origin for executing programs.

Stepper Drive - An amplifier that controls the action of the stepper motors.

Stepper Motor - An axis motor that uses stepper technology.

Surface - The topside of the material used as the Z-axis reference point.

Tool Offset - The distance between the center of the waterjet and the cutting edge. The Tool Offset is also the distance between the desired geometry and the center of the tool path, usually the radius of the waterjet stream.

Tool Path - The path that the center of the waterjet stream takes during a cut.

Transmission - The drive system on SF series using a 4:1 belt drive pulley system to produce rotation of the pinion.

µCito - The native language of the controller (pronounced micro-see-tow).

Waste Abrasive - The leftover abrasive that collects after the cutting sequence.

X Motor Plate - The plate attached to the side of the gantry in which the transmission or gearbox assemblies are bolted.

Y Carriage Plate - The vertical plate behind the Z-axis carriage plate where Z-axis bearing rails are mounted.

Y Motor Plate - The horizontal plate attached to the Y-carriage plate where the Y-axis transmission or gearbox assemblies are bolted.

Z Carriage Plate - The vertical plate on the vertical moving part of the carriage assembly where the cutting tool plate is mounted.

Z Motor Plate - The horizontal plate on top of the Y-carriage plate where the Z-axis motor is mounted.

Z Speed - The vertical speed of the waterjet cutting head.

Software